Memo

TO
Patrick Van Rossem
National Grid
175 East Old Country Road
Hicksville, New York 11801

COPIES TO
John Alonzo, de maximis
Stephen Raymond, GZA
Daniel Amate, GZA
Terry Young, PE-NY, Arcadis

FROM
Michael Benoit, PE-NY

DATE
July 27, 2021

ARCADIS PROJECT NUMBER
30004014.00002

SUBJECT
Bulkhead Barrier Wall Closure at Existing Gas Transmission Tunnel Shaft
Former Citizens Gas Works Manufactured Gas Plant Site
Carroll Gardens/Public Place
Borough of Brooklyn, Kings County, New York

Introduction and Background

This memorandum has been prepared to summarize the remedial elements and existing facilities at the former Citizens Gas Works manufactured gas plant (MGP) site (hereinafter, the "Site") that, collectively, will be used to mitigate the potential migration of remaining dense non-aqueous phase liquid (DNAPL) from the Site to the Gowanus Canal in the area of National Grid's existing gas transmission tunnel shaft on Parcel II of the Site. The Site is generally located at the intersection of Smith and 5th Streets in the Carroll Gardens neighborhood of the Borough of Brooklyn, Kings County, New York and comprises four properties, which are commonly referred to as "Parcel I" (Block 471, Lot 1), "Parcel II" (Block 471, Lot 100), "Parcel III" (Block 471, Lot 200), and "Parcel IV" (Block 468, Lot 25; Figure 1). Parcels I, II, and III of the Site are currently in the New York State Brownfield Cleanup Program (designated as Site Nos. C224012 [Parcels I and II] and C224012B [Parcel III]) and are being remediated by National Grid pursuant to the *Voluntary Cleanup Program Decision Document* (New York State Department of Environmental Conservation 2007) and Brownfield Site Cleanup Agreements (Index Nos. A2-0610-0808 and C224012B-06-19). As part of those remediation activities, a new bulkhead barrier wall was installed on Parcels II and III of the Site along the western edge of the Gowanus Canal. The objectives of the bulkhead barrier wall are to: (1) mitigate the potential migration of DNAPL from the Site to the Gowanus Canal; and (2) retain upland soils both during and after the remediation of the Gowanus Canal Superfund Site (Arcadis of New York, Inc. 2017).

The recently-installed bulkhead barrier wall includes two primary design configurations: (1) a cantilevered combination wall (approximately 496 linear feet), consisting of HZ-M steel king piles with intermediate AZ 19-700 steel sheet piles; and (2) an anchored tieback wall (approximately 383 linear feet), consisting of an AZ 42-700N or AZ 46-700N steel sheet pile headwall connected with tie rods to AZ 36-700N steel sheet pile anchors, which were installed parallel to and between approximately 46 feet and 48 feet inland of the bulkhead headwall. The cantilevered combination wall was installed along Parcel II, where the proximity of the existing Bond-Lorraine Street sewer (a nominal 72-inch inside diameter pile-supported combined sewer) prevents the installation of an anchored tieback wall, and the anchored tieback wall was installed along Parcel III. The steel sheet piles used in the new bulkhead headwall (both for the anchored tieback wall and the cantilevered combination wall portions of the new bulkhead) were driven as shop-welded pairs to a minimum tip elevation of -40.0 feet above the North

American Vertical Datum of 1988 (NAVD88). The HZ-M steel king piles for the cantilevered combination wall on Parcel II of the Site were driven to a minimum tip elevation of between -76.0 feet and -83.0 feet NAVD88, depending on location. A joint sealant (Adeka Ultraseal P-201) was applied in the field to non-welded joints (i.e., between the interlocks of adjacent welded sheet pile pairs and at sheet pile-to-king pile and king pile-to-king pile connections).

The Parcel II bulkhead terminates on both sides of National Grid's existing natural gas transmission tunnel shaft, which was constructed in 1924 and contains active cast iron and steel gas mains that provide critical gas supply to the Red Hook area of Brooklyn. Due to the existing concrete surrounding and overhanging the top approximately 9 feet of the existing gas transmission tunnel shaft (commonly referred to as the "concrete collar"), which could not be completely demolished/removed during the selective demolition of the existing bulkhead, the new Parcel II bulkhead piling could not be driven tight to the sides of the shaft, as originally contemplated in the design documents. Instead, the new bulkhead was terminated approximately 15 inches from the north side of the tunnel shaft and approximately 9 inches from the south side of the tunnel shaft. As shown on Figure 2, a new steel sheet pile closure wall will be installed in front of the existing gas transmission tunnel shaft (between the previously-installed king piles) to close off the small openings between the new bulkhead barrier wall and the sides of the shaft in order to: (1) prevent the loss of fill from behind the bulkhead; and (2) eliminate potential preferential pathways for DNAPL migration from the Site to the Gowanus Canal. The draft design drawings for the new sheet pile closure wall are provided in Attachment A.

The remainder of this memorandum provides a brief overview of the nature and extent of MGP-related impacts in the area of the existing gas transmission tunnel shaft on Parcel II of the Site and the remedial elements and existing Site facilities that will be used to mitigate the potential migration of remaining DNAPL from the Site to the Gowanus Canal.

Nature and Extent of MGP-Related Impacts

Table 1 summarizes the visual impacts (e.g., staining, sheen, NAPL, etc.) observed in the soil borings and existing/former wells located in the vicinity of the existing gas transmission tunnel shaft. Soil boring and existing/former monitoring well locations are shown on Figure 2 and the boring/well construction logs are provided in Attachment B. As indicated in Table 1, DNAPL-saturated soils and soils containing DNAPL coatings are generally limited to the intermediate and deep zones (generally, between elevation -21.5 feet and elevation -70.0 feet NAVD88) in the area of the existing gas transmission tunnel shaft on Parcel II. DNAPL transmissivity testing conducted during the supplemental design investigation (Arcadis of New York, Inc. 2016) showed a low potential for DNAPL recoverability, indicating that, where present, DNAPL in soil is relatively immobile.

Summary of Remedial Elements and Site Facilities

This section summarizes the elements of the Site remedy and the existing Site facilities that, collectively, will be used to mitigate the potential migration of remaining DNAPL from the Site to the Gowanus Canal in the area of the existing gas transmission tunnel shaft on Parcel II of the Site. These remedial elements and existing Site facilities include the following:

- Excavation and off-Site disposal of Parcel I MGP source material;
- Installation of new recovery wells and removal of intermediate/deep DNAPL from the subsurface;

- Existing below-grade steel sheathing/master piles surrounding the tunnel shaft;
- Existing gas transmission tunnel shaft;
- Hydraulic relief system; and
- Sealed sheet pile closure wall.

In addition, the Gowanus Canal remediation adjacent to the Site will also include a combination of sediment removal and capping. The role/function of each of these remedial elements and existing Site facilities is described in additional detail below.

Excavation and Off-Site Disposal of Parcel I MGP Source Material

The remediation activities on Parcel I of the Site include the excavation and off-Site disposal of approximately 35,000 cubic yards of MGP source material, to depths up to 26 feet below grade, from within and adjacent to former Holder Nos. 2, 3, and 5 (Areas 1 through 4 on Figure 1) and the former generator house (Area 12 on Figure 1). The removal of the upgradient MGP source material on Parcel I of the Site will reduce the potential mobility of intermediate/deep DNAPL in the subsurface of the Site.

Installation of New Recovery Wells and Removal of Intermediate/Deep DNAPL from the Subsurface

A network of existing and new recovery wells will be used for the monitoring and removal of intermediate/deep DNAPL from the subsurface of the Site. As shown on Figure 1, a total of four existing recovery wells (CGRW-02, CGRW-04, CGRW-203, and CGRW-206) and seven new recovery wells (CGRW-08 through CGRW-12, CGRW-17, and CGRW-18) will be located upgradient of or adjacent to the existing gas transmission tunnel shaft. Construction details for the existing and new recovery wells at the Site are summarized in Table 2. As indicated in Table 2, new recovery wells will be constructed with 30-foot long screens and 15-foot long sumps to facilitate future DNAPL collection and removal. Further, the new recovery wells to be installed adjacent to the existing gas transmission tunnel shaft (CGRW-17 and CGRW-18; Figure 2) will be screened from approximately elevation -20.0 feet NAVD88 (1 foot above the bottom of the sheet pile closure wall) to approximately elevation -50.0 feet NAVD88. The removal of intermediate/deep DNAPL from areas upgradient and adjacent to the existing gas transmission tunnel shaft will further reduce potential DNAPL mobility.

Existing Below-Grade Steel Sheathing/Master Piles Surrounding the Tunnel Shaft

The existing below-grade steel sheathing/master piles surrounding the tunnel shaft on Parcel II of the Site were installed in 1924 to facilitate the construction of the gas transmission tunnel/shafts and were abandoned in place after the work was completed (Stiles 1926). Based on the available reference drawings, the steel sheets were driven to an average tip elevation of -40.58 feet NAVD88 and the steel master piles were driven to an average tip elevation of -60.56 feet NAVD88. The piles were cut-off at elevation -2.56 feet NAVD88. Figure 2 shows the approximate extent of the existing below-grade steel sheathing/master piles surrounding the existing gas transmission tunnel shaft on Parcel II. Similar to the new bulkhead barrier wall, the existing steel sheathing and master piles surrounding the gas transmission tunnel shaft serve as a physical barrier to the potential migration of shallow/intermediate DNAPL from upgradient areas of the Site to the Gowanus Canal.

Existing Gas Transmission Tunnel Shaft

According to the available reference drawings, the existing gas transmission tunnel shaft on Parcel II of the Site was constructed in 1924 with a 0.5-inch thick steel shell and an approximately 2.5-foot thick reinforced concrete lining (Stiles 1926). Based on the available reference drawings, the bottom of the tunnel shaft is located at elevation -38.73 feet NAVD88 and the top of the shaft is located at elevation 7.19 feet NAVD88. National Grid is currently constructing a reinforced concrete extension on the top of the existing shaft, which will raise the finished elevation of the top of the shaft to 16.0 feet NAVD88. The existing gas transmission tunnel shaft serves as a physical barrier to the potential migration of shallow/intermediate DNAPL from upgradient areas of the Site to the Gowanus Canal.

Hydraulic Relief System

The new bulkhead barrier wall includes a passive hydraulic relief system, which is installed on the upland side of the bulkhead barrier wall to control groundwater mounding in the immediate vicinity of the wall. The system comprises nominal 6-inch diameter perforated high-density polyethylene piping and precast concrete manholes fitted with internal vortex-type hydrodynamic separators (water quality/treatment units). These treatment units will further promote sheen control and the removal of suspended solids, debris, and other floatables (oil/grease, etc.) from the water collected by the system. In the area of the existing gas transmission tunnel shaft on Parcel II of the Site, the average invert elevation of the hydraulic relief piping is 2.03 feet NAVD88. The reduction in hydraulic head on the upland side of the new bulkhead barrier wall will also help to further mitigate the potential movement of residual shallow/intermediate DNAPL located near the wall.

Sealed Sheet Pile Closure Wall

The new steel sheet pile closure wall will be installed in front of the existing gas transmission tunnel shaft (between the previously-installed king piles) to close off the small openings that remain between the new bulkhead barrier wall and the sides of the shaft. As shown on the draft design drawings provided in Attachment A, the sheet piles for the new closure wall will be driven to a tip elevation of -21.5 feet NAVD88 (approximately 2 feet above the top of the existing gas transmission tunnel) and cut-off at elevation 0.0 feet NAVD88. Consistent with the remainder of the bulkhead barrier wall, a joint sealant (Adeka Ultraseal P-201) will be applied to the interlocks of the sheet piles. The sealed sheet pile closure wall will serve as a physical barrier to the potential migration of remaining shallow DNAPL (if any) from upgradient areas of the Site to the Gowanus Canal.

References

Arcadis of New York, Inc. 2016. *Supplemental Design Investigation Report*. Former Citizens Gas Works MGP Site, Carroll Gardens/Public Place, Brooklyn, New York. Prepared for National Grid. June.

Arcadis of New York, Inc. 2017. *100% Remedial Design Report*. Site Remediation, Former Citizens Gas Works MGP Site, Carroll Gardens/Public Place, Brooklyn, New York. Prepared for National Grid. November.

GEI Consultants, Inc. 2015. *Data Summary Report, Barrier Wall Pilot Test Program*. Former Citizens Gas Works MGP Site, Carroll Gardens/Public Place, Brooklyn, New York. Prepared for National Grid. August.

New York State Department of Environmental Conservation. 2007. *Voluntary Cleanup Program Decision Document*. Operable Unit No. 1, Former Citizens Gas Works MGP Site, Carroll Gardens/Public Place, Brooklyn, New York. April 23.

Stiles, L.S. 1926. Pipe Tunnel Under Gowanus Canal, Brooklyn, New York. In *Proceedings of the American Society of Civil Engineers*. New York, New York. January 20-22.

United States Environmental Protection Agency. 2013. *Record of Decision*. Gowanus Canal Superfund Site, Brooklyn, New York. September.

Enclosures

Tables

Table 1. Summary of Visual Impacts Observed in Soil Borings and Existing/Former Wells Located Near Existing Gas Transmission Tunnel Shaft

Table 2. Recovery Well Construction Summary

Figures

Figure 1. Site Plan

Figure 2. Bulkhead Barrier Wall Closure Plan at Existing Gas Transmission Tunnel Shaft

Attachments

Attachment A. Draft Design Drawings for Sheet Pile Closure Wall

Attachment B. Soil Boring and Well Construction Logs

Tables

Table 1

Summary of Visual Impacts Observed in Soil Borings and Existing/Former Wells Located Near Existing Gas Transmission Tunnel Shaft

National Grid
Former Citizens Gas Works Manufactured Gas Plant Site
Borough of Brooklyn, Kings County, New York
NYSDEC Site Nos. C224012 and C224012B

Location ID	Date Completed	Easting (feet NAD83)	Northing (feet NAD83)	Ground Surface Elevation (feet NAVD88)	Total Depth of Boring (feet bgs)	Visual Impacts Observed		
						Depth Interval (feet bgs)	Elevation Interval (feet NAVD88)	Description
B-1	6/9/2015	632217.71	671566.89	13.50	75.00	20.00 - 22.00	-6.50 - -8.50	Trace sheen.
						35.00 - 37.00	-21.50 - -23.50	Layers of DNAPL and staining, sheen.
						40.00 - 42.00	-26.50 - -28.50	Layers of DNAPL and staining, sheen.
						45.00 - 47.00	-31.50 - -33.50	Layers of DNAPL and staining, sheen.
						47.00 - 49.00	-33.50 - -35.50	Layers of DNAPL and staining, sheen.
						49.00 - 51.00	-35.50 - -37.50	Layers of DNAPL and staining, sheen.
						51.00 - 53.00	-37.50 - -39.50	Little sheen.
						53.00 - 55.00	-39.50 - -41.50	Little sheen.
						61.00 - 63.00	-47.50 - -49.50	Trace sheen.
						65.00 - 67.00	-51.50 - -53.50	Trace sheen.
						69.00 - 71.00	-55.50 - -57.50	Trace sheen.
						73.00 - 75.00	-59.50 - -61.50	Trace sheen.
CGRW-04	8/28/2009	632271.16	671595.34	11.14	72.00	NO SOIL LOGGING AT THIS LOCATION		
CGSB-12/CGMW-07D	5/3/2003	632273.60	671588.80	11.01	138.00	18.00 - 19.50	-6.99 - -8.49	Tar blebs, sheen, black-stained.
						19.50 - 21.00	-8.49 - -9.99	Trace sheen.
						21.00 - 22.50	-9.99 - -11.49	Tar stained.
						22.50 - 24.00	-11.49 - -12.99	Tar-stained/tar-coated layers with sheen.
						38.00 - 47.00	-26.99 - -35.99	Heavily tar-coated layers, sheen throughout.
						47.00 - 50.00	-35.99 - -38.99	Heavily tar-coated.
						50.00 - 50.50	-38.99 - -39.49	Lightly tar-stained.
						50.50 - 52.50	-39.49 - -41.49	Sheen throughout.
						58.00 - 68.00	-46.99 - -56.99	Thin tar seam, sheen throughout.
						78.00 - 80.00	-66.99 - -68.99	Lightly-coated tar seam at 80.0'.
						124.00 - 128.00	-112.99 - -116.99	Patchy sheen.
CGSB-124/CGSB-124C	12/12/2008	632195.80	671551.30	13.65	67.00	18.20 - 20.00	-4.55 - -6.35	Sheen.
						31.00 - 32.00	-17.35 - -18.35	NAPL-coated lenses.
						35.00 - 37.00	-21.35 - -23.35	Tar lenses.
						40.00 - 42.00	-26.35 - -28.35	Tar-saturated lenses.
						45.00 - 47.00	-31.35 - -33.35	Sheen.
						50.00 - 52.00	-36.35 - -38.35	Sheen.
						55.00 - 57.00	-41.35 - -43.35	Sheen.

Table 1

Summary of Visual Impacts Observed in Soil Borings and Existing/Former Wells Located Near Existing Gas Transmission Tunnel Shaft

National Grid

Former Citizens Gas Works Manufactured Gas Plant Site

Borough of Brooklyn, Kings County, New York

NYSDEC Site Nos. C224012 and C224012B

Location ID	Date Completed	Easting (feet NAD83)	Northing (feet NAD83)	Ground Surface Elevation (feet NAVD88)	Total Depth of Boring (feet bgs)	Visual Impacts Observed		
						Depth Interval (feet bgs)	Elevation Interval (feet NAVD88)	Description
CGSB-126	12/10/2008	632265.70	671584.50	11.50	91.00	15.00 - 17.00	-3.50 - -5.50	Tar staining.
						17.00 - 19.00	-5.50 - -7.50	Tar staining.
						19.00 - 20.00	-7.50 - -8.50	Tar staining.
						39.00 - 41.00	-27.50 - -29.50	Layers of tar coating.
						44.00 - 46.00	-32.50 - -34.50	Interbedded tar-stained lenses.
						49.00 - 51.00	-37.50 - -39.50	Sheen, tar staining.
						59.00 - 59.50	-47.50 - -48.00	Sheen
						69.00 - 70.00	-57.50 - -58.50	Sheen.
						79.00 - 81.00	-67.50 - -69.50	Tar blebs and globs, tar-coated lenses.
						84.00 - 86.00	-72.50 - -74.50	Slight sheen.
CGSB-141	12/18/2008	632203.60	671575.70	13.50	13.50	13.00 - 13.30	0.50 - 0.20	Stained.
CGSBA-305	8/31/2015	632213.86	671571.71	13.40	62.00	31.40 - 31.53	-18.00 - -18.13	Trace sheen.
						35.00 - 37.00	-21.60 - -23.60	Trace DNAPL.
						40.00 - 40.30	-26.60 - -26.90	Sheen.
						40.30 - 41.90	-26.90 - -28.50	Saturated with DNAPL, sheen.
						41.90 - 42.00	-28.50 - -28.60	Sheen.
						45.00 - 46.00	-31.60 - -32.60	Some DNAPL, some sheen.
						46.00 - 47.00	-32.60 - -33.60	Saturated with DNAPL.
						50.00 - 52.00	-36.60 - -38.60	Little sheen.
						55.00 - 56.00	-41.60 - -42.60	Some sheen.
						60.00 - 62.00	-46.60 - -48.60	Trace sheen.
GW-3	2/3/1989	632214.75	671574.42	NA	16.00	NO VISIBLE IMPACTS OBSERVED AT THIS LOCATION		

Notes:

1. Horizontal reference datum is the North American Datum of 1983 (NAD83), New York State Plane East Zone.
2. Vertical reference datum is the North American Vertical Datum of 1988 (NAVD88).
3. bgs: below ground surface.
4. DNAPL: dense non-aqueous phase liquid.
5. NA: not available.
6. NAPL: non-aqueous phase liquid.

Table 2
Recovery Well Construction Summary

National Grid
Former Citizens Gas Works Manufactured Gas Plant Site
Borough of Brooklyn, Kings County, New York
NYSDEC Site Nos. C224012 and C224012B

Location ID	Date Completed	Property	Easting (feet NAD83)	Northing (feet NAD83)	Ground Surface Elevation (feet NAVD88)	Casing Type	Screen Type	Nominal Diameter (inches)	Screen Slot Size (inches)	Screen Length (feet)	Screened Interval		Sump Length (feet)	Total Depth (feet bgs)
											Depth (feet bgs)	Elevation (feet NAVD88)		
Existing Recovery Wells														
CGMW-40D	12/1/2009	Parcel III	631820.16	671336.81	17.57	Sch. 40 PVC	Sch. 40 PVC	2.0	0.010	10.00	94.50 - 104.50	-76.93 - -86.93	2.00	106.50
CGMW-41I	1/9/2010	Parcel III	631886.44	671254.04	16.28	Sch. 40 PVC	Sch. 40 PVC	2.0	0.010	10.00	51.06 - 61.06	-34.78 - -44.78	2.00	63.06
CGMW-43D	1/14/2010	Parcel III	631795.81	671291.90	17.38	Sch. 40 PVC	Sch. 40 PVC	2.0	0.010	10.00	85.48 - 95.48	-68.10 - -78.10	2.00	97.48
CGRW-02	8/27/2009	Parcel I	632130.27	671767.90	18.29	Sch. 10 SS	Sch. 10 SS	6.0	0.020	15.00	30.00 - 45.00	-11.71 - -26.71	5.00	50.00
CGRW-04	8/28/2009	Parcel II	632271.16	671595.34	11.14	Sch. 10 SS	Sch. 10 SS	6.0	0.020	40.00	27.00 - 67.00	-15.86 - -55.86	5.00	72.00
CGRW-06D	7/9/2009	Parcel III	631952.12	671284.41	10.16	Sch. 10 SS	Sch. 10 SS	6.0	0.030	10.00	80.00 - 90.00	-69.84 - -79.84	5.00	95.00
CGRW-06I	6/11/2009	Parcel III	631945.95	671273.58	10.03	Sch. 10 SS	Sch. 10 SS	6.0	0.020	30.00	32.00 - 62.00	-21.97 - -51.97	5.00	67.00
CGRW-203	5/23/2012	Parcel I	631986.46	671773.56	29.07	Sch. 40 PVC	Sch. 40 PVC	4.0	0.020	20.00	40.00 - 60.00	-10.93 - -30.93	2.00	62.00
CGRW-206	7/12/2012	Parcel I	632156.10	671788.12	18.08	Sch. 40 PVC	Sch. 40 PVC	4.0	0.020	20.00	45.00 - 65.00	-26.92 - -46.92	2.00	67.00
New (Proposed) Recovery Wells														
CGRW-08	10/24/2019	Parcel I	631902.84	671826.90	30.19	Sch. 40 PVC	Sch. 40 PVC	4.0	0.020	30.00	50.10 - 80.10	-19.91 - -49.91	15.00	95.10
CGRW-09	10/23/2019	Parcel I	631945.16	671800.56	30.28	Sch. 40 PVC	Sch. 40 PVC	4.0	0.020	30.00	50.10 - 80.10	-19.82 - -49.82	15.00	95.10
CGRW-10	10/23/2019	Parcel I	632029.67	671747.36	23.91	Sch. 40 PVC	Sch. 40 PVC	4.0	0.020	30.00	44.00 - 74.00	-20.09 - -50.09	15.00	89.00
CGRW-11	10/22/2019	Parcel I	632072.18	671721.10	20.48	Sch. 40 PVC	Sch. 40 PVC	4.0	0.020	30.00	40.00 - 70.00	-19.52 - -49.52	15.00	85.00
CGRW-12	10/21/2019	Parcel I	632105.32	671728.66	19.75	Sch. 40 PVC	Sch. 40 PVC	4.0	0.020	30.00	39.00 - 69.00	-19.25 - -49.25	15.00	84.00
CGRW-13	NA	Parcel II	632648.03	671637.32	8.00	Sch. 10 SS	Sch. 10 SS	6.0	0.020	30.00	27.00 - 57.00	-19.00 - -49.00	15.00	72.00
CGRW-14	NA	Parcel II	632585.17	671638.76	7.78	Sch. 10 SS	Sch. 10 SS	6.0	0.020	30.00	27.00 - 57.00	-19.22 - -49.22	15.00	72.00
CGRW-15	NA	Parcel II	632509.29	671632.59	7.98	Sch. 10 SS	Sch. 10 SS	6.0	0.030	30.00	38.00 - 68.00	-30.02 - -60.02	15.00	83.00
CGRW-16	NA	Parcel II	632414.38	671627.25	10.20	Sch. 10 SS	Sch. 10 SS	6.0	0.030	30.00	40.00 - 70.00	-29.80 - -59.80	15.00	85.00
CGRW-17	NA	Parcel II	632255.90	671564.49	11.83	Sch. 10 SS	Sch. 10 SS	6.0	0.020	30.00	32.00 - 62.00	-20.17 - -50.17	15.00	77.00
CGRW-18	NA	Parcel II	632228.93	671549.43	12.06	Sch. 10 SS	Sch. 10 SS	6.0	0.020	30.00	32.00 - 62.00	-19.94 - -49.94	15.00	77.00
CGRW-19I	NA	Parcel III	632140.80	671471.94	10.00	Sch. 10 SS	Sch. 10 SS	6.0	0.020	30.00	43.00 - 73.00	-33.00 - -63.00	15.00	88.00
CGRW-19D	NA	Parcel III	632135.84	671467.14	10.00	Sch. 10 SS	Sch. 10 SS	6.0	0.020	30.00	73.00 - 103.00	-63.00 - -93.00	15.00	118.00
CGRW-20I	NA	Parcel III	632064.17	671390.99	10.00	Sch. 10 SS	Sch. 10 SS	6.0	0.020	30.00	43.00 - 73.00	-33.00 - -63.00	15.00	88.00
CGRW-20D	NA	Parcel III	632060.44	671385.02	10.00	Sch. 10 SS	Sch. 10 SS	6.0	0.030	30.00	73.00 - 103.00	-63.00 - -93.00	15.00	118.00
CGRW-21I	NA	Parcel III	632008.69	671307.64	10.00	Sch. 10 SS	Sch. 10 SS	6.0	0.020	30.00	43.00 - 73.00	-33.00 - -63.00	15.00	88.00
CGRW-21D	NA	Parcel III	632004.67	671301.91	10.00	Sch. 10 SS	Sch. 10 SS	6.0	0.030	30.00	73.00 - 103.00	-63.00 - -93.00	15.00	118.00
CGRW-22I	NA	Parcel III	631952.05	671227.94	9.92	Sch. 10 SS	Sch. 10 SS	6.0	0.020	30.00	43.00 - 73.00	-33.08 - -63.08	15.00	88.00
CGRW-22D	NA	Parcel III	631947.84	671222.31	9.95	Sch. 10 SS	Sch. 10 SS	6.0	0.030	30.00	73.00 - 103.00	-63.05 - -93.05	15.00	118.00

Notes:

1. Horizontal reference datum is the North American Datum of 1983 (NAD83), New York State Plane East Zone.
2. Vertical reference datum is the North American Vertical Datum of 1988 (NAVD88).
3. bgs: below ground surface.
4. NA: not available. Well has not yet been installed as of the date of this memorandum.
5. PVC: polyvinyl chloride.
6. Sch.: Schedule.
7. SS: stainless steel.

Figures

REMEDIAL EXCAVATION SCHEDULE			
REMEDIAL EXCAVATION AREA	EXCAVATION ELEVATION (FEET NAVD88)	AVG. EXCAVATION DEPTH (FEET BGS)	ESTIMATED EXCAVATION VOLUME (CY)
1	15.0	14.0	6,445
2	3.0	26.0	9,975
3	2.0	26.0	11,725
4	2.0	22.5	4,450
5A	-10.0	20.5	1,565
5B	-10.0	20.5	1,270
6A	-10.0	20.5	2,810
6B	-10.0	20.5	3,975
7	8.5	4.0	100
8	7.0	4.0	15
9	8.0	4.0	20
10	2.0	10.0	950
11	-2.0	16.5	310
12	-8.0	22.0	2,770

LEGEND:

- LIMIT OF BROWNFIELD CLEANUP PROGRAM SITE NO. C224012 (PARCELS I AND II)
- LIMIT OF BROWNFIELD CLEANUP PROGRAM SITE NO. C224012B (PARCEL III)
- LIMIT OF STATE SUPERFUND SITE NO. 224012 (PARCEL IV)
- REMEDIAL EXCAVATION AREA (APPROXIMATE)
- 3 AREA IDENTIFIER
- PROPERTY LINE (APPROXIMATE)
- EASEMENT LINE (APPROXIMATE)
- 21 TOPOGRAPHIC CONTOUR (1–FOOT INTERVAL)
- 5 BATHYMETRIC CONTOUR (1–FOOT INTERVAL)
- EDGE OF WATER
- TREE
- EDGE OF VEGETATION
- EDGE OF PAVEMENT/CONCRETE
- EDGE OF GRAVEL
- EDGE OF SOIL/AGGREGATE PILE (APPROXIMATE)
- EDGE OF BULKHEAD
- CHAIN–LINK FENCE
- BUILDING
- MTA RAILROAD TRACK
- CONCRETE WALL
- BOLLARD
- SIGN
- UTILITY POLE
- HYDRANT
- SANITARY SEWER MANHOLE
- STORM SEWER MANHOLE
- WATER MANHOLE
- GAS MANHOLE
- TELECOMMINICATIONS MANHOLE
- ELECTRICAL MANHOLE
- MANHOLE (TYPE UNKNOWN)
- CATCH BASIN
- ELECTRICAL BOX
- WATER VALVE
- GAS VALVE
- CGSS–19 SURFACE SOIL SAMPLE
- CGSB–103 SOIL BORING
- CGCPT–120 CONE PENETROMETER SOUNDING
- CGTP–14 TEST PIT
- CGPZ–07 NEW (PROPOSED) PIEZOMETER
- CGPZ–42S EXISTING PIEZOMETER
- CGPZ–2S FORMER (DECOMMISSIONED) PIEZOMETER
- CGMW–01S EXISTING MONITORING WELL
- CGMW–02I FORMER (DECOMMISSIONED) MONITORING WELL
- CGRW–08 NEW (PROPOSED) RECOVERY WELL
- CGRW–04 EXISTING RECOVERY WELL
- CGRW–07S FORMER (DECOMMISSIONED) RECOVERY WELL
- CGSB–301 (GP) GEOPHYSICAL/GEOTECHNICAL MONITORING POINT
- IMP–02 INCLINOMETER MONITORING POINT

0 50' 100'
GRAPHIC SCALE

NOTES:

1. HORIZONTAL REFERENCE DATUM IS THE NORTH AMERICAN DATUM OF 1983 (NAD83), NEW YORK STATE PLANE EAST ZONE.
2. VERTICAL REFERENCE DATUM IS THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).

REFERENCE DRAWINGS:

1. GEOD CORPORATION. DRAWING TITLED "BOUNDARY & TOPOGRAPHIC SURVEY, BLOCK 471, LOTS 1, 100 & 200, BLOCK 468, LOT 25, BOROUGH OF BROOKLYN, KINGS CO., CITY AND STATE OF NEW YORK", DATED JANUARY 15, 2016. PREPARED FOR ARCADIS OF NEW YORK, INC.
2. OCEAN SURVEYS, INC. DRAWING NUMBER 1, SHEET NUMBER 2 OF 3, TITLED "MULTIBEAM HYDROGRAPHY, GOWANUS CANAL, BROOKLYN, NEW YORK", DATED NOVEMBER 11, 2014. PREPARED FOR GEOSYNTEC CONSULTANTS, INC.

NATIONAL GRID
FORMER CITIZENS GAS WORKS MANUFACTURED GAS PLANT SITE
BOROUGH OF BROOKLYN, KINGS COUNTY, NEW YORK

SITE PLAN

ARCADIS

FIGURE 1

C:\Users\mwasilewski\OneDrive - ARCADIS\BIM 360 Docs\AUS-NATIONAL GRID-FORMER CITIZENS MGP-BROOKLYN New York\Project Files\2021101-In Progress\01-DWG\NYSDEC_07-F01 SITE PLAN.dwg LAYOUT: 1 SAVED: 7/23/2021 1:48 PM ACADVER: 23.1S (LMS TECH) PAGESETUP: ----
PLOTSTYLETABLE: PLTCONT.CTB PLOTTED: 7/23/2021 1:48 PM BY: WASILEWSKI, MATT
XREFS:
36728X01
36728X03
36728X02
36728X04

XREFS:
36728X01
36728X03ALTERNATE
36728X02
36728X04
36728X09

CGTP-17
CGTP-17A
CGTPA-213
CGTPA-212
CGTP-203
CGSB-141
GW-3
CGSBA-305
B-1
CGSB-124/CGSB-124C
CGSB-126
CGRW-04
CGMW-07S
CGSBA-304
CGSB-12
CGMW-07D
CGMW-07I
EXISTING BELOW-GRADE STEEL SHEATHING AND MASTER PILE FROM 1924 CONSTRUCTION OF GAS TRANSMISSION TUNNEL (TYP.)
EXISTING GAS TRANSMISSION TUNNEL SHAFT
NEW TREATMENT UNIT FOR HYDRAULIC RELIEF SYSTEM (TYP.)
MH-4
CGRW-18
CGRW-17
CGPZ-09
CO-5A
NEW CLEANOUT FOR HYDRAULIC RELIEF SYSTEM (TYP.)
MH-3
CGPZ-10
CO-4A
NEW STEEL SHEET PILE CLOSURE WALL
NEW BULKHEAD BARRIER WALL (TYP.)
NEW WALE (TYP.)
EXISTING GAS TRANSMISSION TUNNEL (BENEATH CANAL)

LEGEND:

- LIMIT OF BROWNFIELD CLEANUP PROGRAM SITE NO. C224012 (PARCELS I AND II)
- PROPERTY LINE (APPROXIMATE)
- EASEMENT LINE (APPROXIMATE)
- LIMIT OF GRADING
- EXISTING GRADE TOPOGRAPHIC CONTOUR (1-FOOT INTERVAL)
- FINAL GRADE TOPOGRAPHIC CONTOUR (1-FOOT INTERVAL)
- FINAL GRADE SPOT ELEVATION
- BATHYMETRIC CONTOUR (1-FOOT INTERVAL)
- NEW ASPHALT PAVEMENT
- NEW RIPRAP
- CGSB-141 SOIL BORING
- CGTPA-212 TEST PIT
- CGPZ-09 NEW (PROPOSED) PIEZOMETER
- CGMW-07S FORMER (DECOMMISSIONED) MONITORING WELL
- CGRW-17 NEW (PROPOSED) RECOVERY WELL
- CGRW-04 EXISTING RECOVERY WELL

1"=5' (5' 0 5' 10')

NOTES:

1. HORIZONTAL REFERENCE DATUM IS THE NORTH AMERICAN DATUM OF 1983 (NAD83), NEW YORK STATE PLANE EAST ZONE.
2. VERTICAL REFERENCE DATUM IS THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).

REFERENCE DRAWINGS:

1. GEOD CORPORATION. DRAWING TITLED "BOUNDARY & TOPOGRAPHIC SURVEY, BLOCK 471, LOTS 1, 100 & 200, BLOCK 468, LOT 25, BOROUGH OF BROOKLYN, KINGS CO., CITY AND STATE OF NEW YORK", DATED JANUARY 15, 2016. PREPARED FOR ARCADIS OF NEW YORK, INC.
2. OCEAN SURVEYS, INC. DRAWING NUMBER 1, SHEET NUMBER 2 OF 3, TITLED "MULTIBEAM HYDROGRAPHY, GOWANUS CANAL, BROOKLYN, NEW YORK", DATED NOVEMBER 11, 2014. PREPARED FOR GEOSYNTEC CONSULTANTS, INC.

NATIONAL GRID
FORMER CITIZENS GAS WORKS MANUFACTURED GAS PLANT SITE
BOROUGH OF BROOKLYN, KINGS COUNTY, NEW YORK

BULKHEAD BARRIER WALL CLOSURE PLAN AT EXISTING GAS TRANSMISSION TUNNEL SHAFT

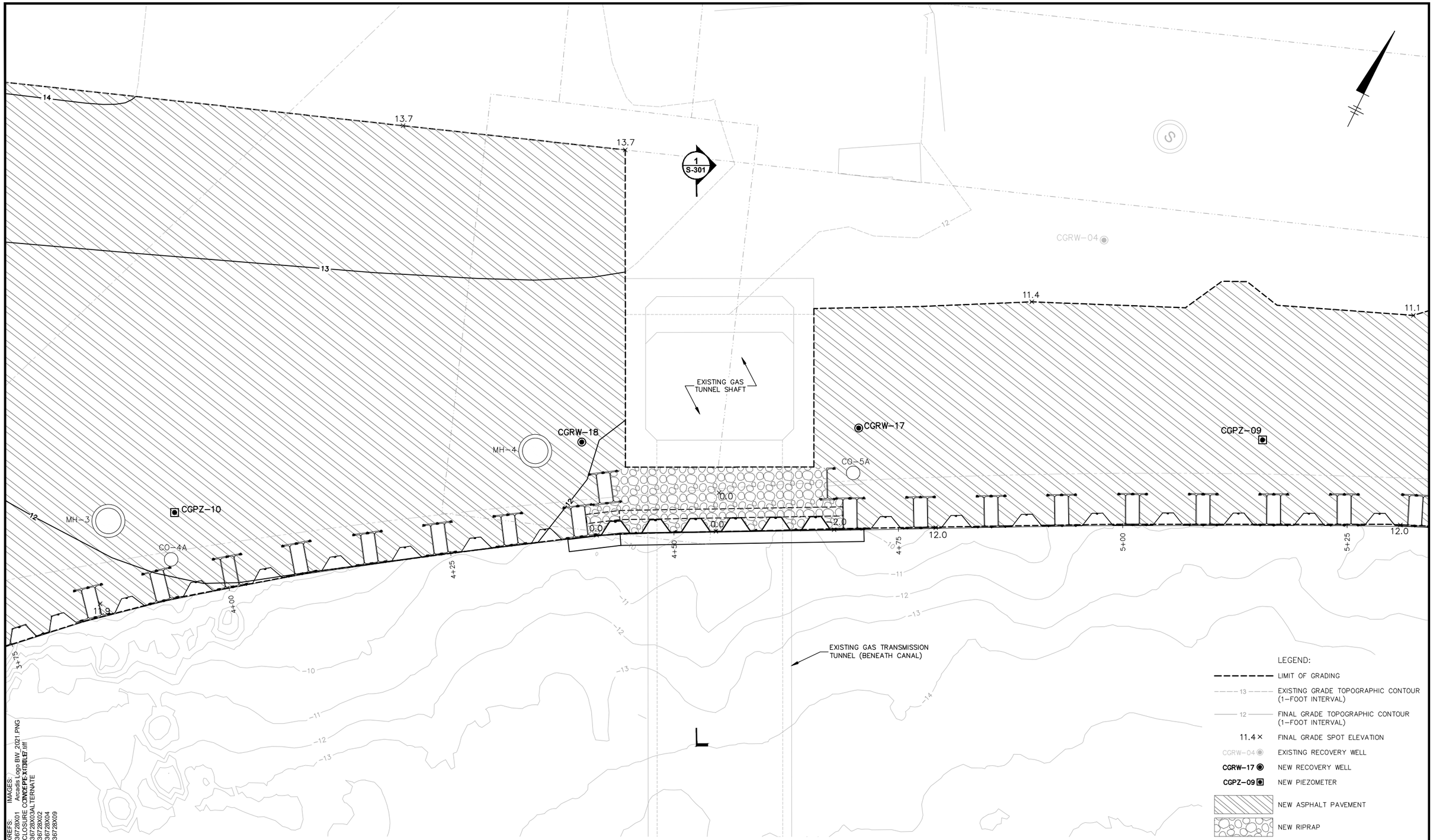
ARCADIS

FIGURE 2

Attachments

Attachment A

Draft Design Drawings for Sheet Pile Closure Wall



XREFS: IMAGES:
36728X01 Arcadis Logo BW_2021.PNG
CLOSURE CONCEPT 2-C-101-SOFT SHORELINE.tif
36728X03ALTERNATE
36728X02
36728X04
36728X09

1"=5' (5' 0 5' 10')

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name: **TERRY W. YOUNG**
Professional Engineer's No.: 074847

State	Date Signed	Project Mgr.
NY		MJB
Designed by	Drawn by	Checked by
NWF/MJB	JLH	MJB

DRAFT NOT FOR CONSTRUCTION

ARCADIS
ARCADIS OF NEW YORK, INC.

NATIONAL GRID USA • BROOKLYN, NEW YORK
FORMER CITIZENS GAS WORKS MANUFACTURED GAS PLANT SITE
CARROLL GARDENS/PUBLIC PLACE
BOROUGH OF BROOKLYN, KINGS COUNTY, NEW YORK
SITE REMEDIATION

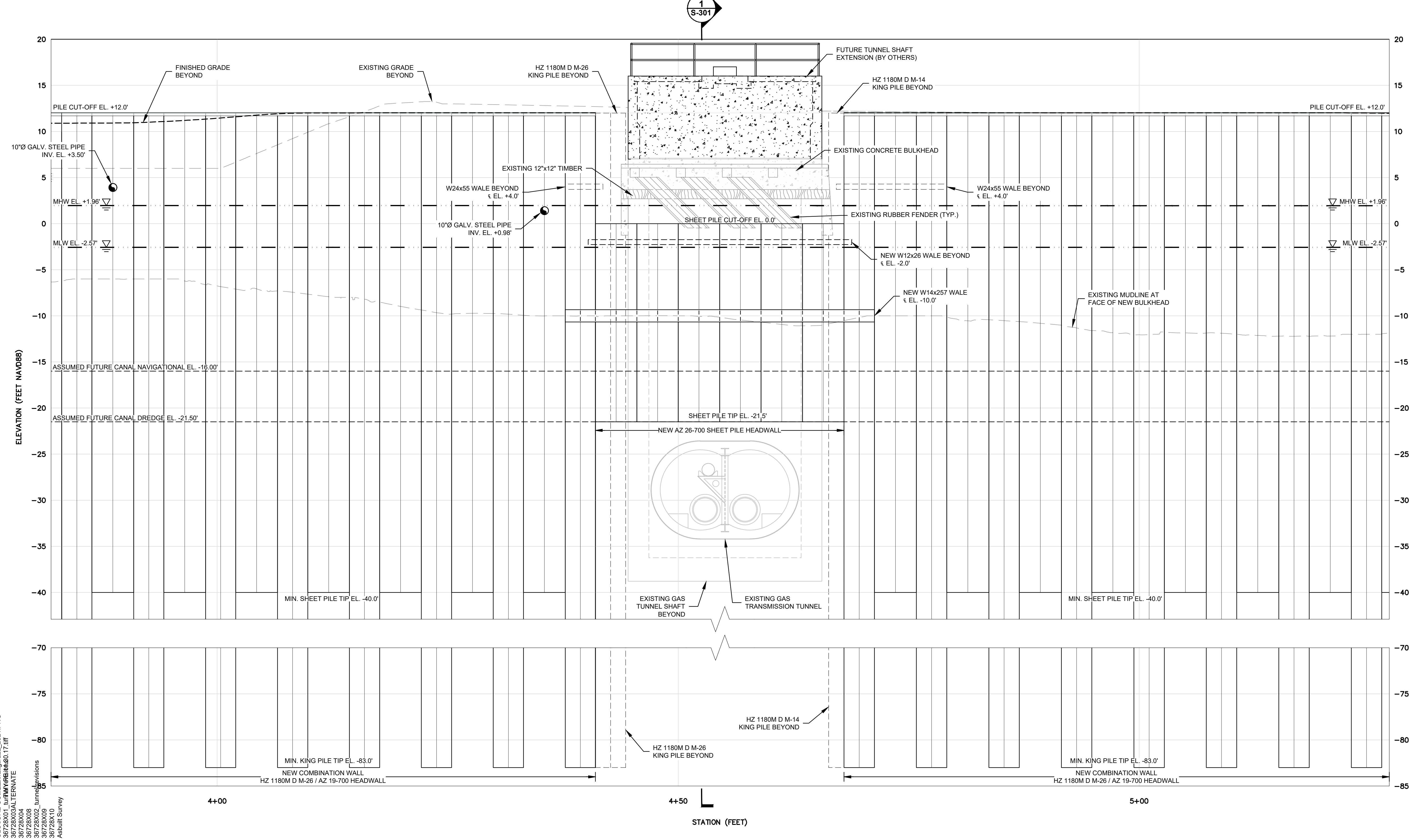
CONCEPTUAL RESTORATION AND FINAL GRADING PLAN FOR HYBRID CLOSURE CONCEPT WITH EXTERIOR BOTTOM WALE

Arcadis Project No.
30004014.00002

Date
JULY 2021

Arcadis
One Lincoln Center
110 West Fayette Street, Suite 300
Syracuse, NY 13202
Tel. 315.446.9120

C-101



1"=5' HORIZONTAL AND VERTICAL SCALE (5' 0 5' 10')

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

THIS DRAWING IS THE PROPERTY OF THE ARCADIS ENTITY IDENTIFIED IN THE TITLE BLOCK AND MAY NOT BE REUSED OR ALTERED IN WHOLE OR IN PART WITHOUT THE EXPRESS WRITTEN PERMISSION OF SAME.

Professional Engineer's Name		
TERRY W. YOUNG		
Professional Engineer's No. 074847		
State: NY	Date Signed:	Project Mgr.: MJB
Designed by: MSG/LAB	Drawn by: JLH	Checked by: MJB

DRAFT NOT FOR CONSTRUCTION

ARCADIS
ARCADIS OF NEW YORK, INC.

NO ALTERATIONS PERMITTED HEREON EXCEPT AS PROVIDED UNDER SECTION 7209 SUBDIVISION 2 OF THE NEW YORK STATE EDUCATION LAW

NATIONAL GRID USA • BROOKLYN, NEW YORK
FORMER CITIZENS GAS WORKS MANUFACTURED GAS PLANT SITE
CARROLL GARDENS/PUBLIC PLACE
BOROUGH OF BROOKLYN, KINGS COUNTY, NEW YORK
SITE REMEDIATION

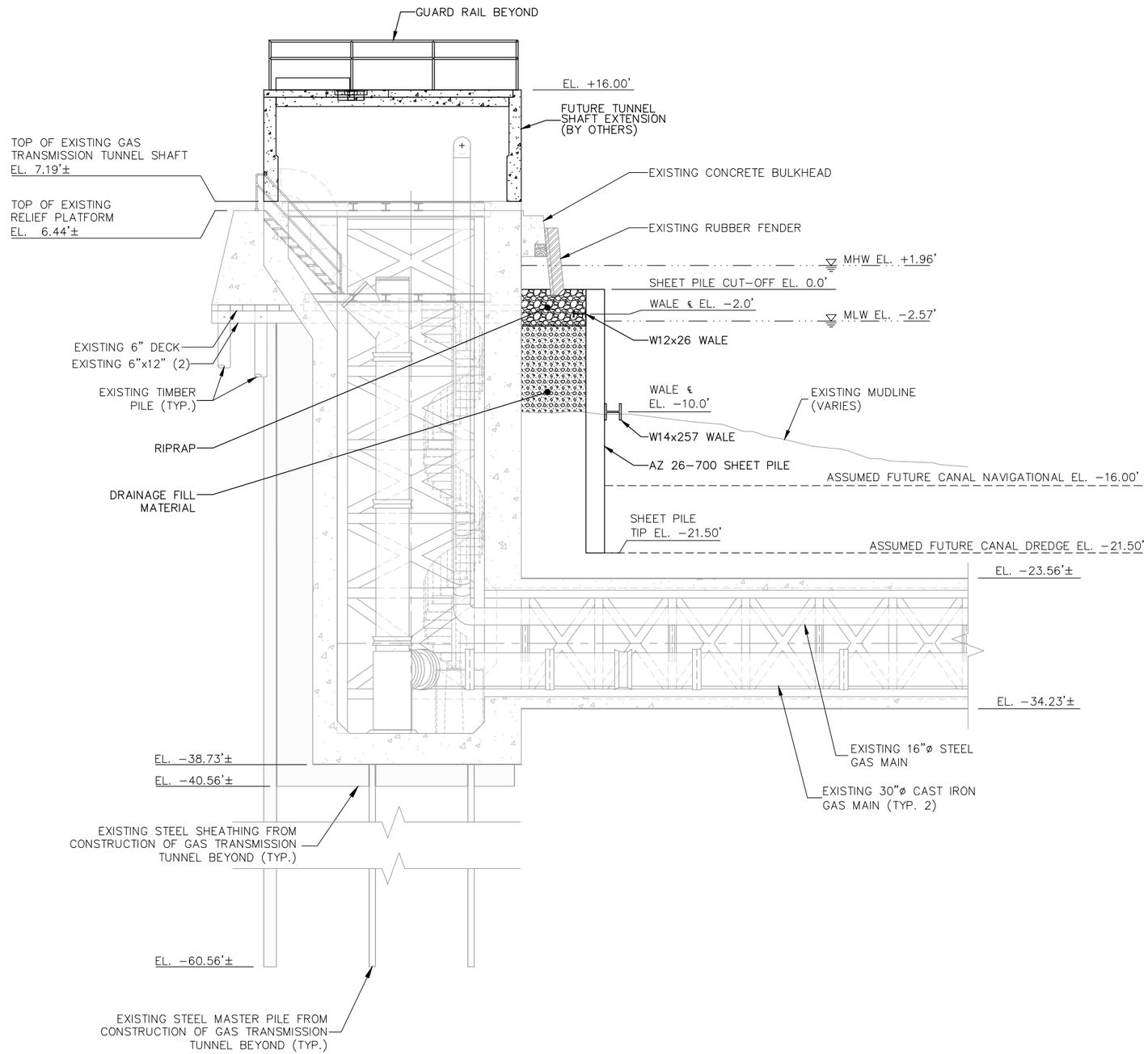
CONCEPTUAL BULKHEAD BARRIER WALL PROFILE FOR HYBRID CLOSURE CONCEPT WITH EXTERIOR BOTTOM WALE

Arcadis Project No. 30004014.00002

Date JULY 2021

Arcadis
One Lincoln Center
110 West Fayette Street, Suite 300
Syracuse, NY 13202
Tel. 315.446.9120

S-201



C:\Users\jlharris\ACCDocs\Arcadis\AUS-NATIONAL GRID-FORMER CITIZENS MGP-BROOKLYN New York\Project Files\2021\01-In Progress\01-DWG\CLOSURE CONCEPT 2-S-301-SECTION.dwg LAYOUT: S-301 SAVED: 7/12/2021 10:05 AM PLOTSTYLETABLE: --- PLOTTED: 7/12/2021 11:35 AM BY: HARRIS, JESS

XREFS:
IMAGES:
CLOSURE CONCEPT Wall Extension 1 of 2.png
Arcadis Logo BW_2021.PNG
TWY PE 11.30.17.tiff

1"=5' (5' 0 5' 10')

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name: **TERRY W. YOUNG**
Professional Engineer's No.: 074847

State	Date Signed	Project Mgr.
NY		MJB
Designed by	Drawn by	Checked by
MSG/LAB	JLH	MJB

DRAFT NOT FOR CONSTRUCTION

ARCADIS
ARCADIS OF NEW YORK, INC.

NATIONAL GRID USA • BROOKLYN, NEW YORK
FORMER CITIZENS GAS WORKS MANUFACTURED GAS PLANT SITE
CARROLL GARDENS/PUBLIC PLACE
BOROUGH OF BROOKLYN, KINGS COUNTY, NEW YORK
SITE REMEDIATION

CONCEPTUAL BULKHEAD BARRIER WALL SECTION FOR HYBRID CLOSURE CONCEPT WITH BOTTOM EXTERIOR WALE

Arcadis Project No.
30004014.00002

Date
JULY 2021

Arcadis
One Lincoln Center
110 West Fayette Street, Suite 300
Syracuse, NY 13202
Tel. 315.446.9120

S-301

Attachment B

Soil Boring and Well Construction Logs

Date Start/Finish: 6/4/2015 - 6/9/2015
Drilling Company: Soil Mechanics Drilling Corp.
Driller's Name: Glenn Sindco
Drilling Method: Hollow Stem Augur/Mud Rotary
Rig Type: Truck-Mounted CME-46/CME-41
Sampling Method: 2" x 2' Split Spoon

Northing: 671566.89
Easting: 632217.71

Borehole Depth: 75 feet bgs
Surface Elevation: 13.50

Descriptions By: Matthew Bell

Well/Boring ID: **B-1**

Client: National Grid

Location: Former Citizens Gas Works MGP Site
Parcel II (Block 471, Lot 100)
Brooklyn, New York

DEPTH / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blow Counts	N - Value	PID Headspace (ppm)	PP (tsf)	Geologic Column	Stratigraphic Description	Well/Boring Construction
15										
0										
10	1	0-5	5	NA	NA	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	NA		Black fine to medium SAND, little Silt, trace Gravel, trace Organics (roots), trace Debris (concrete pipe fragments). Suspected asbestos-containing material (pipe fragments) at 3 feet bgs. Hand-cleared to 5 feet bgs on 6/4/2015.	
5	2	5-7	0.3	1 1 1 2	2	0.3	NA		Black and brown fine to medium SAND, little Gravel, very loose, dry.	
5										Borehole backfilled with bentonite/grout to grade.
10	3	10-12	0.4	WOR 34 5 1	28	0.0	NA		Black and brown fine to medium SAND, little Gravel, dense, wet.	
0										
15	4	15-17	0.9	2 2	6	0.0	NA		Black and brown fine to medium SAND, little Gravel, little Debris (concrete and brick fragments), dense, wet.	

ARCADIS Design & Consultancy for natural and built assets

Remarks: MGP = manufactured gas plant; NA = not applicable/available; NR = no recovery; PP = pocket penetrometer; tsf = tons per square foot; WOR = weight of rod.

Horizontal reference datum is the North American Datum of 1983 (NAD83), New York State Plane East Zone (FIPS 3101). Vertical reference datum is the North American Vertical Datum of 1988 (NAVD88).

Boring hand-cleared on 6/4/2015 by Summit Drilling Co., Inc.
Boring drilled on 6/9/2015 by Soil Mechanics Drilling Corp.

Client: National Grid

Well/Boring ID: **B-1**

Borehole Depth: 75 feet bgs

Site Location:
Former Citizens Gas Works MGP Site
Parcel II (Block 471, Lot 100)
Brooklyn, New York

DEPTH / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blow Counts	N - Value	PID Headspace (ppm)	PP (tsf)	Geologic Column	Stratigraphic Description	Well/Boring Construction
	4	15-17	0.9	4 50/3"	6	0.0	NA		Black and brown fine to medium SAND, little Gravel, little Debris (concrete and brick fragments), dense, wet. Auger refused at 16.5 feet bgs on 6/5/2015. Resumed drilling on 6/8/2015.	
-5										
20	5	20-22	1.0	4 2 1 2	3	0.0 2.3	NA		Gray fine to coarse SAND, some Silt, little Debirs (wood fragments, slag), odor, trace sheen, very loose, wet.	
-10										
25	6	25-27	2.0	WOR WOR 1 2	NA	2.3 0.0 0.0 0.0	NA		Dark gray CLAY, little Silt, trace Organics (shell fragments), soft, moist.	Borehole backfilled with bentonite/grout to grade.
-15									Wood observed in mud tub from 29.0 to 29.5 feet bgs.	
30	7	30-32	0.1	2 2 2 3	4	0.0	NA		Gray SILTY CLAY, trace Organics (wood fragments), soft, wet.	
-20										
35	8	35-37	1.6	6 8	20	312.9 11.4	NA		Gray and brown fine to medium SAND, some Silt, trace Clay, odor, sheen, layers of DNAPL and staining, medium dense, wet.	

ARCADIS Design & Consultancy for natural and built assets

Remarks: MGP = manufactured gas plant; NA = not applicable/available; NR = no recovery; PP = pocket penetrometer; tsf = tons per square foot; WOR = weight of rod.

Horizontal reference datum is the North American Datum of 1983 (NAD83), New York State Plane East Zone (FIPS 3101). Vertical reference datum is the North American Vertical Datum of 1988 (NAVD88).

Boring hand-cleared on 6/4/2015 by Summit Drilling Co., Inc.
Boring drilled on 6/9/2015 by Soil Mechanics Drilling Corp.

Client: National Grid

Well/Boring ID: **B-1**

Borehole Depth: 75 feet bgs

Site Location:
Former Citizens Gas Works MGP Site
Parcel II (Block 471, Lot 100)
Brooklyn, New York

DEPTH / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blow Counts	N - Value	PID Headspace (ppm)	PP (tsf)	Geologic Column	Stratigraphic Description	Well/Boring Construction
	8	35-37	1.6	12 11	20	67.8 0.0	NA		Gray and brown fine to medium SAND, some Silt, trace Clay, odor, sheen, layers of DNAPL and staining, medium dense, wet.	
-25										
40	9	40-42	1.3	8 8 8 11	16	274.2 473.1 334.6	NA		Gray and brown fine to medium SAND, some Silt, trace Clay, odor, sheen, layers of DNAPL and staining, medium dense, wet.	
-30										
45	10	45-47	1.5	3 3 4 5	7	96.8 322.4 218.4 238.1	NA		Gray and brown fine SAND and SILT, trace Clay, odor, sheen, layers of DNAPL and staining, loose, wet.	Borehole backfilled with bentonite/grout to grade.
	11	47-49	1.3	5 5 5 7	10	NA	NA			
-35									Layer of DNAPL and staining from 49.1 to 49.3 feet bgs	
50	12	49-51	1.3	5 5 5 6	10	214.9 74.1 67.8	NA			
	13	51-53	1.4	5 5 5 10	10	53.4 33.9 23.8	NA		Gray and brown fine to medium SAND, little Silt, odor, little sheen, loose, wet.	
-40	14	53-55	1.4	5 6 6 7	12	80.7 27.2 17.1	NA		Some Silt, medium dense.	
55	NA	NA	NR	NA	NA	NA	NA		NO RECOVERY (Driller overdrilled sample interval).	

ARCADIS Design & Consultancy for natural and built assets

Remarks: MGP = manufactured gas plant; NA = not applicable/available; NR = no recovery; PP = pocket penetrometer; tsf = tons per square foot; WOR = weight of rod.

Horizontal reference datum is the North American Datum of 1983 (NAD83), New York State Plane East Zone (FIPS 3101). Vertical reference datum is the North American Vertical Datum of 1988 (NAVD88).

Boring hand-cleared on 6/4/2015 by Summit Drilling Co., Inc.
Boring drilled on 6/9/2015 by Soil Mechanics Drilling Corp.

Client: National Grid

Well/Boring ID: **B-1**

Borehole Depth: 75 feet bgs

Site Location:
Former Citizens Gas Works MGP Site
Parcel II (Block 471, Lot 100)
Brooklyn, New York

DEPTH / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blow Counts	N - Value	PID Headspace (ppm)	PP (tsf)	Geologic Column	Stratigraphic Description	Well/Boring Construction
	NA	NA	NR	NA	NA	NA	NA		NO RECOVERY (Driller overdrilled sample interval).	
-45	15	57-59	1.3	6 6 8 9	14	8.9 11.9 14.1	NA		Brown fine SAND, little Silt, slight odor, medium dense, wet.	
60	16	59-61	1.7	NA	NA	NA	NA		Shelby tube pressed 24".	
	17	61-63	1.9	3 4 3 4	7	0.0 3.6 10.6 8.7	NA		Brown and gray SILT, some Clay, little fine Sand, trace sheen, loose, wet.	
-50	18	63-65	1.6	NA	NA	NA	NA		Shelby tube pressed 24".	
65	19	65-67	1.5	7 5 5 10	10	20.3 43.9 70.0	NA		Brown fine SAND and SILT, layer of gray CLAY, high plasticity, trace sheen, very loose, wet.	Borehole backfilled with bentonite/grout to grade.
-55	20	67-69	1.0	NA	NA	NA	NA		Shelby tube pressed 15".	
70	21	69-71	1.8	7 7 7 8	14	22.8 30.2 16.6 46.1	NA		Brown fine to medium SAND, little Silt, slight odor, trace sheen, medium dense, wet.	
	22	71-73	1.6	8 10 10 12	20	4.9 68.4 58.7 10.4	NA		Trace Silt, no sheen.	
-60	23	73-75	1.3	6 8 11 12	19	16.4 7.0 20.1	NA		Little Silt, trace sheen.	
75									End of boring at 75 feet bgs. Borehole backfilled on 6/9/2015.	

ARCADIS Design & Consultancy for natural and built assets

Remarks: MGP = manufactured gas plant; NA = not applicable/available; NR = no recovery; PP = pocket penetrometer; tsf = tons per square foot; WOR = weight of rod.

Horizontal reference datum is the North American Datum of 1983 (NAD83), New York State Plane East Zone (FIPS 3101). Vertical reference datum is the North American Vertical Datum of 1988 (NAVD88).

Boring hand-cleared on 6/4/2015 by Summit Drilling Co., Inc.
Boring drilled on 6/9/2015 by Soil Mechanics Drilling Corp.

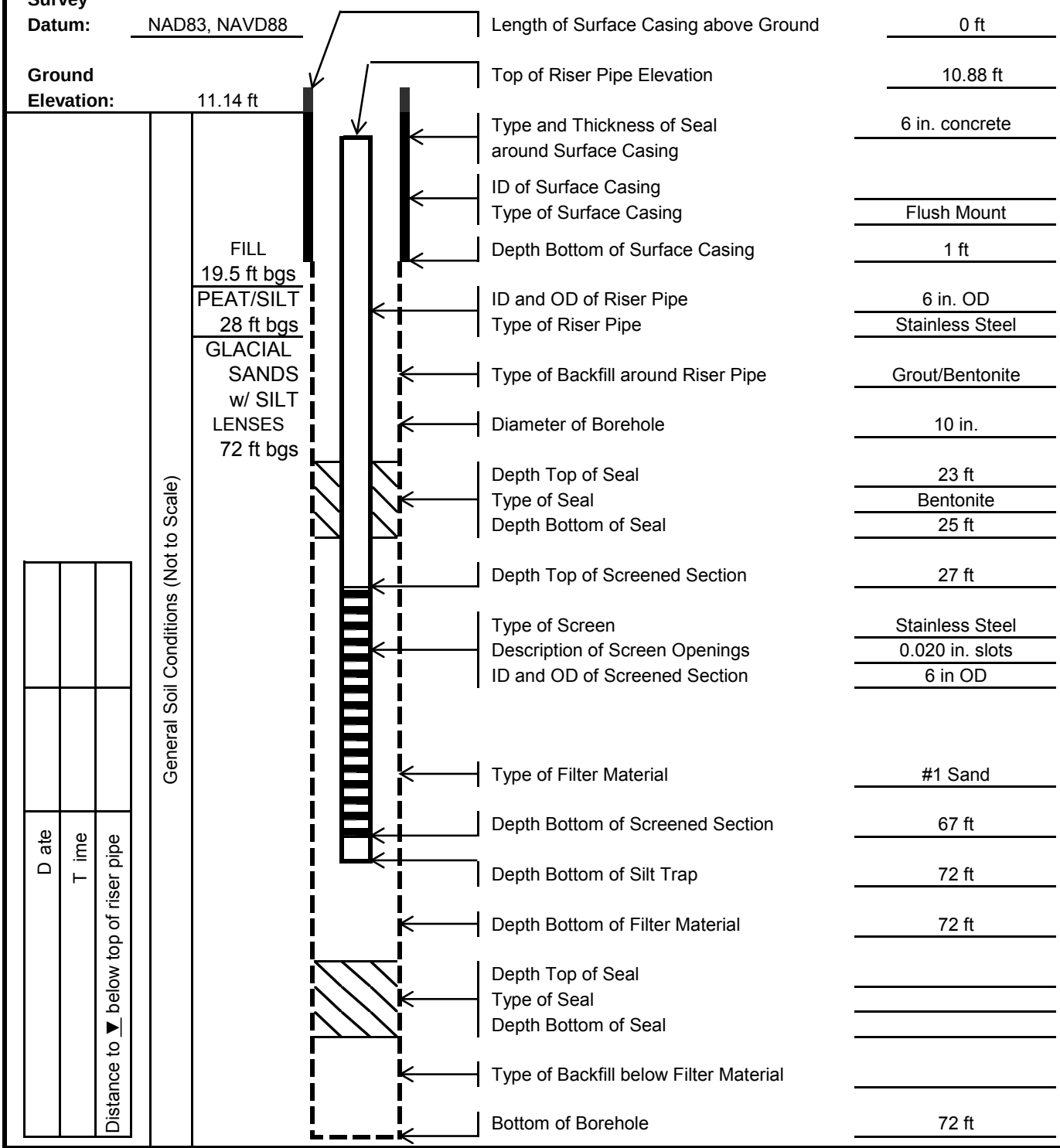
Recovery Well Construction Log

CGRW-04

Project	Citizens Gas Works Recovery Well Installation	**GEI Proj. No.**	061140-19-2807
City / Town	Brooklyn, New York	**Location**	Parcel I
Client	National Grid		N 671595.34
Contractor	Frontz Drilling Co.		E 632271.16
Driller	C. Lauer **GEI Rep.** M. Sweet	**Install Date**	8/28/2009

Survey Datum: NAD83, NAVD88

Ground Elevation: 11.14 ft



Length of Surface Casing above Ground	0 ft
Top of Riser Pipe Elevation	10.88 ft
Type and Thickness of Seal around Surface Casing	6 in. concrete
ID of Surface Casing	
Type of Surface Casing	Flush Mount
Depth Bottom of Surface Casing	1 ft
ID and OD of Riser Pipe	6 in. OD
Type of Riser Pipe	Stainless Steel
Type of Backfill around Riser Pipe	Grout/Bentonite
Diameter of Borehole	10 in.
Depth Top of Seal	23 ft
Type of Seal	Bentonite
Depth Bottom of Seal	25 ft
Depth Top of Screened Section	27 ft
Type of Screen	Stainless Steel
Description of Screen Openings	0.020 in. slots
ID and OD of Screened Section	6 in OD
Type of Filter Material	#1 Sand
Depth Bottom of Screened Section	67 ft
Depth Bottom of Silt Trap	72 ft
Depth Bottom of Filter Material	72 ft
Depth Top of Seal	
Type of Seal	
Depth Bottom of Seal	
Type of Backfill below Filter Material	
Bottom of Borehole	72 ft

Notes:

Horizontal Datum - North American Datum of 1983 (NAD83) (NY East Zone 3101)
Horizontal Datum - North American Vertical Datum of 1988 (NAVD88)
Well construction depths measured in feet below ground surface (ft bgs)
Soil conditions based on adjacent boring CGSB-126

GEI Consultants

Site Id: CGMW-07D

GEI Consultants, Inc.

Client: KeySpan Corporation			
Project Number: 982482-8-1903	Project Name: Citizens Gas Works	Date Started: 03/27/03	Date Completed: 05/03/03
Remarks: CGMW-07D was completed within CGSB-12. Geology, physical observation, and analytical samples for CGMW-07D were obtained from CGSB-12. Due to lack of recovery at CGMW-07D/CGSB-12, CGMW-07I was used for geology and physical observations.		Ground Elevation: 11.01'	Datum: NAVD 88
		Contractor: Prosonic	Total Depth: 138.00'
		Drilling Method: Resonant Sonic	
		Logged By: Melissa Wells	Certified By: Katie Amos

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description: color, density, SOIL, admixture, moisture, other notes, ORIGIN.	Analyzed Sample Interval	Lithology / Vis. Signs of Contamination	Odors	Elevation (ft)
0-2	NA	50			0.0-3.0: Gravel and cobble-sized CONCRETE, no visual impacts, no odors. (CR)				10
2-8	NA	100			3.0-6.0: Wet, CONCRETE, no visual impacts, no odors. (CR)				
					6.0-8.0: Dry, CONCRETE, no visual impacts, no odors. (CR)			NONE	
8-18	NA	70			8.0-9.0: Gravel and cobble-sized CONCRETE, no visual impacts, no odors. (CR)				
					9.0-13.0: CONCRETE rock flour, no visual impacts, no odors. (CR)				0
				10					
					13.0-18.0: FILL (wood), faint creosote odor. (FI)				

Legend: Physical Observations

- None
- Stain
- Lenses, Grain Coatings and Blebs
- Interbedded Tar Layers
- Tar Saturated

Site Id: CGMW-07D

GEI Consultants, Inc.

Client: KeySpan Corporation	
Project Number: 982482-8-1903	Project Name: Citizens Gas Works
Remarks: CGMW-07D was completed within CGSB-12. Geology, physical observation, and analytical samples for CGMW-07D were obtained from CGSB-12. Due to lack of recovery at CGMW-07D/CGSB-12, CGMW-07I was used for geology and physical observations.	
Date Started: 03/27/03	Date Completed: 05/03/03
Ground Elevation: 11.01'	Datum: NAVD 88
Contractor: Prosonic	Total Depth: 138.00'
Drilling Method: Resonant Sonic	
Logged By: Melissa Wells	Certified By: Katie Amos

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description color, density, SOIL, admixture, moisture, other notes, ORIGIN.	Analyzed Sample Interval	Lithology / Physical Observations	Odors	Elevation (ft)	Well Construction
					CGMW-07S is a shallow monitoring well, part of CGMW-07 well cluster. CGMW-07S WELL CONSTRUCTION; Measuring Point Elevation 10.71' tor 8.0-0.0 Grout 12.0-8.0 Seal 28.0-12.0 Sand 26.0-16.0 Screen 28.0-26.0 Sump			FAINT		
18-38	NA	40	246 ppm		18.0-19.5: Black-stained, wet, FILL, wood, sheen, tar blebs, moderate mixed petroleum and sewage odor. (FI)					
			65.6 ppm			18.0-20.0		MODERATE		
				20	19.5-21.0: Gray, wet, CLAY, little fine sand, trace organics, moderately dense, cohesive, trace sheen, no odor. (CL)			NONE		
					21.0-22.5: Brown, wet, medium SAND, loose, non-cohesive, tar stained, moderate tar odor. (SP)				-10	
					22.5-24.0: Brown, wet, CLAY and SILT, moderately dense, cohesive, with layers of tar-stained/coated fine sand with sheen, moderate tar odor. (OL)			MODERATE		
			439 ppm			23.5-24.0				
					24.0-38.0: No recovery. (UN)					

Legend: Physical Observations

- None
- Stain
- Lenses, Grain Coatings and Blebs
- Interbedded Tar Layers
- Tar Saturated

Site Id: CGMW-07D

GEI Consultants, Inc.

Client: KeySpan Corporation	
Project Number: 982482-8-1903	Project Name: Citizens Gas Works
Remarks: CGMW-07D was completed within CGSB-12. Geology, physical observation, and analytical samples for CGMW-07D were obtained from CGSB-12. Due to lack of recovery at CGMW-07D/CGSB-12, CGMW-07I was used for geology and physical observations.	
Date Started: 03/27/03	Date Completed: 05/03/03
Ground Elevation: 11.01'	Datum: NAVD 88
Contractor: Prosonic	Total Depth: 138.00'
Drilling Method: Resonant Sonic	
Logged By: Melissa Wells	Certified By: Katie Amos

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description: color, density, SOIL, admixture, moisture, other notes, ORIGIN.	Analyzed Sample Interval	Lithology / Physical Observations	Odors	Elevation (ft)	Well Construction
38-58	NA	90		40	38.0-47.0: Brown, wet, SILT, with layers of heavily tar-coated medium sand, moderately dense, cohesive, sheen throughout, moderate tar odor. (SM)			MODERATE	-20 -30	

Legend: Physical Observations

- None
- Stain
- Lenses, Grain Coatings and Blebs
- Interbedded Tar Layers
- Tar Saturated

Site Id: CGMW-07D

GEI Consultants, Inc.

Client: KeySpan Corporation	
Project Number: 982482-8-1903	Project Name: Citizens Gas Works
Remarks: CGMW-07D was completed within CGSB-12. Geology, physical observation, and analytical samples for CGMW-07D were obtained from CGSB-12. Due to lack of recovery at CGMW-07D/CGSB-12, CGMW-07I was used for geology and physical observations.	
Date Started: 03/27/03	Date Completed: 05/03/03
Ground Elevation: 11.01'	Datum: NAVD 88
Contractor: Prosonic	Total Depth: 138.00'
Drilling Method: Resonant Sonic	
Logged By: Melissa Wells	Certified By: Katie Amos

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description (color, density, SOIL, admixture, moisture, other notes, ORIGIN.)	Analyzed Sample Interval	Lithology / Physical Observations	Odors	Elevation (ft)	Well Construction
			1206 ppm		47.0–50.0: Brown, wet, medium SAND, loose, non-cohesive, well-sorted, heavily tar coated, strong tar odor. (SP)			STRONG		
			551 ppm			49.0–50.0				
				50	50.0–50.5: Brown, wet, SILT and fine SAND, dense, cohesive, lightly tar stained, faint tar odor. (SM)					
					50.5–52.5: Brown, wet, coarse SAND, loose, non-cohesive, sheen throughout, faint odor. (SP)			FAINT	-40	
					52.5–58.0: Brown, wet, SILT, little clay, trace fine sand, dense, cohesive, no visual impacts, no odors. (ML)			NONE		
			128 ppm							
58–68	NA	90			58.0–68.0: Brown, wet, medium SAND, loose, non-cohesive, 3" layer of gray clay at 66.0', thin tar seam directly below clay, sheen throughout, faint naphthalene odor. (SP)					

Legend: Physical Observations

- None
- Stain
- Lenses, Grain Coatings and Blebs
- Interbedded Tar Layers
- Tar Saturated

Site Id: CGMW-07D

GEI Consultants, Inc.

Client: KeySpan Corporation	
Project Number: 982482-8-1903	Project Name: Citizens Gas Works
Remarks: CGMW-07D was completed within CGSB-12. Geology, physical observation, and analytical samples for CGMW-07D were obtained from CGSB-12. Due to lack of recovery at CGMW-07D/CGSB-12, CGMW-07I was used for geology and physical observations.	
Date Started: 03/27/03	Date Completed: 05/03/03
Ground Elevation: 11.01'	Datum: NAVD 88
Contractor: Prosonic	Total Depth: 138.00'
Drilling Method: Resonant Sonic	
Logged By: Melissa Wells	Certified By: Katie Amos

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description color, density, SOIL, admixture, moisture, other notes, ORIGIN.	Analyzed Sample Interval	Lithology / Physical Observations	Odors	Elevation (ft)	Well Construction
					CGMW-07I is an intermediate monitoring well, part of CGMW-07 well cluster. CGMW-07I WELL CONSTRUCTION: Measuring Point Elevation 10.52' tor 50.0-0.0 Grout 55.0-50.0 Seal 73.0-55.0 Sand 71.0-61.0 Screen 73.0-71.0 Sump			FAINT	-50	
			3400 ppm			66.0				
68-78	NA	0	437 ppm		68.0-78.0: No recovery. (UN)					
				70					-60	

Legend: Physical Observations

- None
- Stain
- Lenses, Grain Coatings and Blebs
- Interbedded Tar Layers
- Tar Saturated

Site Id: CGMW-07D

GEI Consultants, Inc.

Client: KeySpan Corporation	
Project Number: 982482-8-1903	Project Name: Citizens Gas Works
Remarks: CGMW-07D was completed within CGSB-12. Geology, physical observation, and analytical samples for CGMW-07D were obtained from CGSB-12. Due to lack of recovery at CGMW-07D/CGSB-12, CGMW-07I was used for geology and physical observations.	
Date Started: 03/27/03	Date Completed: 05/03/03
Ground Elevation: 11.01'	Datum: NAVD 88
Contractor: Prosonic	Total Depth: 138.00'
Drilling Method: Resonant Sonic	
Logged By: Melissa Wells	Certified By: Katie Amos

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description (color, density, SOIL, admixture, moisture, other notes, ORIGIN.)	Analyzed Sample Interval	Lithology / Physical Observations	Odors	Elevation (ft)	Well Construction
78-88	NA	80	9999 ppm		78.0-80.0: Brown, wet, medium SAND, some gravel, moderately dense, semi-cohesive, poorly-sorted, lightly coated tar seam at 80.0', moderate naphthalene odor. (SW)					
				80	80.0-84.0: SAA, no visual impacts, moderate naphthalene odor. (SW)			MODERATE	-70	
					84.0-86.0: Brown, wet, TILL, SILT, little fine sand, some gravel, large cobble at bottom, dense, cohesive, poorly-sorted, no visual impacts, no odors. (ML)			NONE		
					86.0-98.0: No recovery. (UN)					
88-98	NA	0								

Legend: Physical Observations

- None
- Stain
- Lenses, Grain Coatings and Blebs
- Interbedded Tar Layers
- Tar Saturated

Site Id: CGMW-07D

GEI Consultants, Inc.

Client: KeySpan Corporation	
Project Number: 982482-8-1903	Project Name: Citizens Gas Works
Remarks: CGMW-07D was completed within CGSB-12. Geology, physical observation, and analytical samples for CGMW-07D were obtained from CGSB-12. Due to lack of recovery at CGMW-07D/CGSB-12, CGMW-07I was used for geology and physical observations.	
Date Started: 03/27/03	Date Completed: 05/03/03
Ground Elevation: 11.01'	Datum: NAVD 88
Contractor: Prosonic	Total Depth: 138.00'
Drilling Method: Resonant Sonic	
Logged By: Melissa Wells	Certified By: Katie Amos

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description color, density, SOIL, admixture, moisture, other notes, ORIGIN.	Analyzed Sample Interval	Lithology / Physical Observations	Odors	Elevation (ft)	Well Construction
									-80	
			149 ppm							
98-118	NA	90			98.0-105.0: Brown, wet, medium SAND and SILT, some cobbles and gravel, moderately dense, semi-cohesive, poorly-sorted, no visual impacts, no odors. (SM)			NONE	-90	
				100						

Legend: Physical Observations

- None
- Stain
- Lenses, Grain Coatings and Blebs
- Interbedded Tar Layers
- Tar Saturated

Site Id: CGMW-07D

GEI Consultants, Inc.

Client: KeySpan Corporation	
Project Number: 982482-8-1903	Project Name: Citizens Gas Works
Remarks: CGMW-07D was completed within CGSB-12. Geology, physical observation, and analytical samples for CGMW-07D were obtained from CGSB-12. Due to lack of recovery at CGMW-07D/CGSB-12, CGMW-07I was used for geology and physical observations.	
Date Started: 03/27/03	Date Completed: 05/03/03
Ground Elevation: 11.01'	Datum: NAVD 88
Contractor: Prosonic	Total Depth: 138.00'
Drilling Method: Resonant Sonic	
Logged By: Melissa Wells	Certified By: Katie Amos

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description: color, density, SOIL, admixture, moisture, other notes, ORIGIN.	Analyzed Sample Interval	Lithology	Physical Observations	Odors	Elevation (ft)	Well Construction
			123 ppm		105.0–118.0: Brown, wet, medium SAND, loose, non-cohesive, well-sorted, no visual impacts, no odors. (SP)						
				110	CGMW-07D WELL CONSTRUCTION; Measuring Point Elevation 10.69' tor 111.0–0.0 Grout 114.5–111.5 Seal 130.0–114.5 Sand 128.0–118.0 Screen 130.0–128.0 Sump				NONE	–100	
			1.5 ppm								
118–128	NA	100			118.0–124.0: Brown, wet, coarse SAND, loose, non-cohesive, well-sorted, no visual impacts, no odors. (SP)						

Legend: Physical Observations

- None
- Stain
- Lenses, Grain Coatings and Blebs
- Interbedded Tar Layers
- Tar Saturated

Site Id: CGMW-07D

GEI Consultants, Inc.

Client: KeySpan Corporation	
Project Number: 982482-8-1903	Project Name: Citizens Gas Works
Remarks: CGMW-07D was completed within CGSB-12. Geology, physical observation, and analytical samples for CGMW-07D were obtained from CGSB-12. Due to lack of recovery at CGMW-07D/CGSB-12, CGMW-07I was used for geology and physical observations.	
Date Started: 03/27/03	Date Completed: 05/03/03
Ground Elevation: 11.01'	Datum: NAVD 88
Contractor: Prosonic	Total Depth: 138.00'
Drilling Method: Resonant Sonic	
Logged By: Melissa Wells	Certified By: Katie Amos

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description (color, density, SOIL, admixture, moisture, other notes, ORIGIN.)	Analyzed Sample Interval	Lithology / Physical Observations	Odors	Elevation (ft)	Well Construction
			24.9 ppm						-110	
			37.4 ppm					NONE		
			86 ppm		124.0–128.0: Brown, wet, medium SAND, loose, non-cohesive, well-sorted, patchy sheen, faint naphthalene odor. (SP)	125–125.5		FAINT		
128–138	NA	100		130	128.0–131.5: Gray, wet, CLAY, trace shells, very dense, cohesive, well-sorted, no visual impacts, no odors. (CH)				-120	
					131.5–138.0: Brown, wet, medium to coarse SAND, loose, non-cohesive, no visual impacts, no odors. (SP)			NONE		

Legend: Physical Observations

- None
- Stain
- Lenses, Grain Coatings and Blebs
- Interbedded Tar Layers
- Tar Saturated

Site Id: CGMW-07D

GEI Consultants, Inc.

Client: KeySpan Corporation	
Project Number: 982482-8-1903	Project Name: Citizens Gas Works
Remarks: CGMW-07D was completed within CGSB-12. Geology, physical observation, and analytical samples for CGMW-07D were obtained from CGSB-12. Due to lack of recovery at CGMW-07D/CGSB-12, CGMW-07I was used for geology and physical observations.	
Date Started: 03/27/03	Date Completed: 05/03/03
Ground Elevation: 11.01'	Datum: NAVD 88
Contractor: Prosonic	Total Depth: 138.00'
Drilling Method: Resonant Sonic	
Logged By: Melissa Wells	Certified By: Katie Amos

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description: color, density, SOIL, admixture, moisture, other notes, ORIGIN.	Analyzed Sample Interval	Lithology / Physical Observations	Odors	Elevation (ft)	Well Construction
			3.2 ppm							
					138.0: End of boring.					
				140					-130	

Legend: Physical Observations

- None
- Stain
- Lenses, Grain Coatings and Blebs
- Interbedded Tar Layers
- Tar Saturated

GEI Consultants, Inc.
455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Citizens Gas Works
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093250

BORING LOG
PAGE 1 of 4
CGSB-124/CGSB-124C

GROUND SURFACE ELEVATION (FT): 13.65 **LOCATION:** I14
NORTHING (FT): 671551 **EASTING (FT):** 632196 **TOTAL DEPTH (FT):** 67.0
DRILLED BY: Summit Drilling / Jeremy Logel **DATUM VERT. / HORZ.:** NAVD 1988 / NAD83 NY East Zone
LOGGED BY: Matt Sweet **DATE START / END:** 12/12/2008
DRILLING DETAILS: Hollow Stem Auger/Mud Rotary / Truck Mounted Mobile 61 / Hammer: 140 lbs / Drop: 30 in.
WATER LEVEL ELEVATIONS (FT):
GENERAL NOTE:
GENERAL NOTE:

ELEV. FT.	DEPTH FT.	SAMPLE INFORMATION: TYPE and NO.	PEN/REC IN./IN.	BLOWS (/6 in.)	FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION
	0	G-1 124	60/60	NA	PID= NM ppm				(0'- 5') HAND CLEARED.
10									
	5	S-1 124	24/8	1-1-7-7	PID= 1.8 ppm				S-1 (5'- 7') SILTY SAND WITH GRAVEL (SM); ~50% sand, fine to coarse, ~25% gravel, fine to coarse, angular, ~25% fines; max. size 1", moist, black brown, concrete and brick fragments. FILL.
		S-2 124	24/12	4-6-9-6	PID= 0.4 ppm				S-2 (7'- 9') SILTY SAND WITH GRAVEL (SM); ~50% sand, fine to coarse, ~25% gravel, fine to coarse, angular, ~25% fines; max. size 1", moist, black brown, concrete and brick fragments. Burnt material. FILL.
5		S-3 124	24/10	17-9-3-4	PID= 1.4 ppm				S-3 (9'- 11') SILTY SAND WITH GRAVEL (SM); ~50% sand, fine to coarse, ~35% gravel, fine to coarse, subangular, ~15% fines; max. size 1.5", wet, black tan, concrete fragments and steel pieces. FILL.
	10	S-4 124	22/NM	12-7-5-50/3"	PID= 25.2 ppm				S-4 (11'- 12.8') SILTY SAND WITH GRAVEL (SM); ~60% sand, fine to coarse, ~20% gravel, fine to coarse, angular, ~20% fines; max. size 1", wet, dark red brown, concrete fragments and steel pieces. Timber in sampler tip. FILL.
0		S-5 124	22/6	31-12-7-50/3"	PID= 13.2 ppm				S-5 (13'- 14.8') WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~60% sand, fine to coarse, ~30% gravel, fine to coarse, ~10% fines; max. size 1", wet, dark gray, mostly timber fragments. Concrete in sampler tip. FILL.
	15								

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL
REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING (JAR HEADSPACE)

NA = NOT APPLICABLE
NM = NOT MEASURED
Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK

ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET

NLO = NAPHTHALENE LIKE ODOR
PLO = PETROLEUM LIKE ODOR
TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR
CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
MLO = MUSTY LIKE ODOR

CITIZENS 2010_ENV/GEO LOG W/SMWC ALL CITIZENS BORINGS.GPJ NG GINT DATA TEMPLATE.GDT 5/24/11

GEI Consultants

GEI Consultants, Inc.
455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Citizens Gas Works
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093250

BORING LOG

PAGE 2 of 4

CGSB-124/CGSB-124C

ELEV. FT.	DEPTH FT.	SAMPLE INFORMATION: TYPE and NO.	PEN/REC IN./IN.	BLOWS (/6 in.)	FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION
	15	S-6 124	4/2	50/4"	PID= 47.1 ppm			CrLO	S-6 (15'- 15.3') Timber and brick fragments, strong creosote-like odor, possible piling, FILL.
									(17'- 17.5') Timber. FILL.
									(17.5'- 18') Concrete. FILL.
-5		S-7 124	24/2	30-19-8-2	PID= 147 ppm			CrLO	S-7A (18'- 18.2') Concrete. FILL. S-7B (18.2'- 20') Sand and slag/clinker. moderate creosote-like odor, wet, black. Some timber. Sheen, FILL.
	20	S-8 124	24/18	0-0-1-1	PID= 39.1 ppm			OLO	S-8 (20'- 22') LEAN CLAY (CL); ~95% fines, medium plasticity, low dry strength, no dilatancy, low toughness; ~5% organics/peat, slight organic-like odor, wet, gray.
-10		T-1 124	24/14	P-U-S-H	PID= NA ppm				T-1 (22'- 24') WIDELY GRADED GRAVEL WITH SAND (GW); Shelby tube discarded; bent at bottom and appears to contain sand and gravel.
		S-9 124	24/12	19-21-6-2	PID= NM ppm				S-9A (24'- 24.2') SILTY GRAVEL WITH SAND (GM); ~45% gravel, fine to coarse, angular, ~40% fines, ~15% sand, fine to coarse; wet, black. S-9B (24.2'- 26') LEAN CLAY (CL); ~100% fines, low plasticity, slow dilatancy; wet, gray.
	25								
-15									
	30	S-10 124C	24/24	14-14-18-25	PID= 6.8 ppm				S-10A (30'- 31') LEAN CLAY (CL); ~95% fines, high plasticity, medium toughness; ~5% organics, gray green.
					PID= 118 ppm				S-10B (31'- 32') SANDY LEAN CLAY (CL); ~50% sand, fine, ~50% fines, slow dilatancy; lensed, wet, NAPL coated lenses.

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL
REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING (JAR HEADSPACE)

NA = NOT APPLICABLE
NM = NOT MEASURED
Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK

ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET

NLO = NAPHTHALENE LIKE ODOR
PLO = PETROLEUM LIKE ODOR
TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR

CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
MLO = MUSTY LIKE ODOR

CITIZENS 2010_ENV/GEO LOG W/SMWC ALL CITIZENS BORINGS.GPJ NG GINT DATA TEMPLATE.GDT 5/24/11

GEI Consultants

GEI Consultants, Inc.
455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Citizens Gas Works
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093250

BORING LOG

PAGE 3 of 4

CGSB-124/CGSB-124C

ELEV. FT.	DEPTH FT.	SAMPLE INFORMATION: TYPE and NO.	PEN/REC IN./IN.	BLOWS (/6 in.)	FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION
-20	35	S-11 124C	24/12	11-17-17-20	PID= 119 ppm			TLO	S-11 (35'- 37') SILTY SAND (SM); ~75% sand, fine, ~25% fines, non plastic, slow dilatancy; layered, moderate tar-like odor, wet, dark brown, tar lenses.
-25	40	S-12 124C	24/18	4-14-15-14	PID= 165 ppm			TLO	S-12 (40'- 42') SILTY SAND (SM); ~70% sand, fine, ~30% fines, low plasticity, slow dilatancy, low toughness; varved/lensed, moderate tar-like odor, wet, dark brown / gray, tar saturated lenses.
-30	45	S-13 124C	24/18	1-0-0-0	PID= 170 ppm			TLO	S-13 (45'- 47') NARROWLY GRADED SAND (SP); ~95% sand, fine; ~5% silty fines, strong tar-like odor, wet, brown, sheen.
-35	50	S-14 124C	24/15	1-2-4-7	PID= 145 ppm			TLO	S-14 (50'- 52') NARROWLY GRADED SAND (SP); ~95% sand, fine; ~5% silty fines, strong tar-like odor, wet, brown, sheen.

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL
REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING (JAR HEADSPACE)

NA = NOT APPLICABLE
NM = NOT MEASURED
Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK

ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET

NLO = NAPHTHALENE LIKE ODOR
PLO = PETROLEUM LIKE ODOR
TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR

CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
MLO = MUSTY LIKE ODOR

CITIZENS 2010_ENV/GEO LOG W/SMWC ALL CITIZENS BORINGS.GPJ NG GINT DATA TEMPLATE.GDT 5/24/11

GEI Consultants

GEI Consultants, Inc.
455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Citizens Gas Works
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093250

BORING LOG

PAGE 4 of 4

CGSB-124/CGSB-124C

ELEV. FT.	DEPTH FT.	SAMPLE INFORMATION: TYPE and NO.	PEN/REC IN./IN.	BLOWS (/6 in.)	FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION
-40	55	S-15 124C	24/16	3-4-7-11	PID= 384 ppm			TLO	S-15 (55'- 57') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine, ~10% fines; moderate tar-like odor, wet, brown, fines content increases with depth. Sheen.
-45	60	S-16 124C	24/15	3-5-6-9	PID= 186 ppm			TLO	S-16 (60'- 62') SANDY LEAN CLAY (MH); ~50% sand, fine, ~50% fines, low plasticity, slow dilatancy, low toughness; varved/lensed, slight tar-like odor, wet, brown, fine sand and silt layers.
-50	65	S-17 124C	24/17	4-5-6-5	PID= 69.8 ppm			TLO	S-17A (65'- 66.9') SILTY SAND (SM); ~80% sand, fine to medium, ~20% fines, non plastic, no dilatancy; slight tar-like odor, wet, brown.
					PID= 43.9 ppm				S-17B (66.9'- 70') LEAN CLAY (CL); gray. End of Boring at 67 feet. Soil classification from 0'- 30' from CGSB-124, refusal at 30'. Refusal at CGSB-124B. Soil classification from 30'- 67' from CGSB-124C. Fill with cuttings.

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL
REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING (JAR HEADSPACE)

NA = NOT APPLICABLE
NM = NOT MEASURED
Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK

ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET

NLO = NAPHTHALENE LIKE ODOR
PLO = PETROLEUM LIKE ODOR
TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR

CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
MLO = MUSTY LIKE ODOR

CITIZENS 2010_ENV/GEO LOG W/SMWC ALL CITIZENS BORINGS.GPJ NG GINT DATA TEMPLATE.GDT 5/24/11

GEI Consultants

GEI Consultants, Inc.
455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Citizens Gas Works
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093250

BORING LOG
PAGE 1 of 6
CGSB-126

GROUND SURFACE ELEVATION (FT): 11.50 **LOCATION:** Parcel III - H15
NORTHING (FT): 671585 **EASTING (FT):** 632266 **TOTAL DEPTH (FT):** 91.0
DRILLED BY: Summit Drilling / Jeremy Logel **DATUM VERT. / HORZ.:** NAVD 1988 / NAD83 NY East Zone
LOGGED BY: Matt Sweet **DATE START / END:** 12/9/2008 - 12/10/2008
DRILLING DETAILS: Hollow Stem Auger/Mud Rotary / Truck Mounted Mobile 61 / Hammer: 140 lbs / Drop: 30 in.
WATER LEVEL ELEVATIONS (FT): ▽ -3.50 12/9/2008 10:30 pm
GENERAL NOTE:
GENERAL NOTE:

ELEV. FT.	DEPTH FT.	SAMPLE INFORMATION: TYPE and NO.	PEN/REC IN./IN.	BLOWS (/6 in.)	FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION
	0	G-1	60/60	NA	PID= NM ppm				G-1 (0'- 5') HAND CLEARED.
10									
	5	S-1	22/4	11-25-24-50/4"	PID= 1.1 ppm				S-1 (5'- 6.8') SILTY SAND (SM); ~70% sand, fine to coarse, ~20% fines, ~10% gravel, fine, angular; wet, gray brown, concrete and brick fragments. FILL.
5									(6.8'- 13') Concrete. FILL.
	10								
0		S-2	24/3	11-5-8-13	PID= 89.7 ppm			TLO	S-2 (13'- 15') SILTY SAND (SM); ~75% sand, fine to coarse, ~25% fines; slight tar-like odor, wet, gray, concrete dust and fragments, timber. FILL.
▽	15								

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL
REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING (JAR HEADSPACE)

NA = NOT APPLICABLE
NM = NOT MEASURED
Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK

ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET

NLO = NAPHTHALENE LIKE ODOR
PLO = PETROLEUM LIKE ODOR
TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR
CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
MLO = MUSTY LIKE ODOR

CITIZENS 2010_ENV/GEO LOG W/SMWC_ALL CITIZENS BORINGS.GPJ NG GINT DATA TEMPLATE.GDT 5/24/11

GEI Consultants

GEI Consultants, Inc.
455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Citizens Gas Works
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093250

BORING LOG
PAGE 2 of 6
CGSB-126

ELEV. FT.	DEPTH FT.	SAMPLE INFORMATION: TYPE and NO.	PEN/REC IN./IN.	BLOWS (/6 in.)	FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION
	15	S-3	24/2	24-18-2-2	PID= 92 ppm			TLO	S-3 (15'- 17') SILTY GRAVEL WITH SAND (GM); ~60% gravel, fine to coarse, angular, ~25% sand, fine to coarse, ~15% fines; max. size 1.5", strong tar-like odor, wet, brown, concrete and tile fragments. Tar staining. FILL.
-5		S-4	24/4	4-2-2-3	PID= 93.8 ppm			TLO	S-4 (17'- 19') SILTY SAND WITH GRAVEL (SM); ~50% sand, fine to coarse, ~30% gravel, fine to coarse, angular, ~20% fines; max. size 1.25", strong tar-like odor, wet, brown, concrete fragments. Tar staining. FILL.
	20	S-5	24/18	0-1-2-3	PID= 199 ppm PID= 99.1 ppm			TLO OLO	S-5A (19'- 20') SILTY GRAVEL WITH SAND (GM); ~50% gravel, fine to coarse, angular, ~30% fines, ~20% sand, fine to coarse; max. size 1.5", strong tar-like odor, wet, black brown, tar staining. S-5B (20'- 21') ORGANIC SOIL (OH); ~90% fines, low plasticity, slow dilatancy, low toughness, ~10% sand, fine to medium; slight organic-like odor, moist, gray, sample contains organics, shell fragments.
-10		S-6	24/10	2-2-2-2	PID= 72.5 ppm			OLO	S-6 (21'- 23') ORGANIC SOIL (OH); ~90% fines, low plasticity, slow dilatancy, low toughness, ~10% sand; slight organic-like odor, moist, gray, sample contains organics.
		T-1	24/24	P-U-S-H	PID= NA ppm Q_P= 0.5 tsf S_V= 0.3 tsf				T-1 (23'- 25') ORGANIC SOIL (OH); Shelby tube pushed.
	25	S-7	24/22	0-1-4-4	PID= 37.2 ppm			OLO	S-7 (25'- 27') ORGANIC SOIL (OH); ~90% fines, low plasticity, slow dilatancy, low toughness, ~10% sand; slight organic-like odor, moist, gray, sample contains organics, shell fragments, wood fragments.
-15		S-8	24/4	6-6-7-8	PID= 13.6 ppm PID= 9 ppm				S-8A (27'- 28.2') ORGANIC SOIL (OH); ~100% fines, medium plasticity, slow dilatancy, low toughness; moist to wet, gray. S-8B (28.2'- 29') ORGANIC SOIL (OH); ~100% fines, low plasticity, medium dry strength, slow dilatancy, medium toughness; trace organics/peat, wet, gray, shell fragments.
	30								
-20									

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL
REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING (JAR HEADSPACE)

NA = NOT APPLICABLE
NM = NOT MEASURED
Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK

ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET

NLO = NAPHTHALENE LIKE ODOR
PLO = PETROLEUM LIKE ODOR
TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR
CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
MLO = MUSTY LIKE ODOR

CITIZENS 2010_ENV/GEO LOG W/SMWC ALL CITIZENS BORINGS.GPJ NG GINT DATA TEMPLATE.GDT 5/24/11

GEI Consultants, Inc.
455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Citizens Gas Works
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093250

BORING LOG

CGSB-126

ELEV. FT.	DEPTH FT.	SAMPLE INFORMATION: TYPE and NO.	PEN/REC IN./IN.	BLOWS (/6 in.)	FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION
	35	S-9	24/12	12-15-20-10	PID= 133 ppm				S-9 (34'- 36') SANDY SILT (ML); ~60% fines, low plasticity, slow dilatancy, ~40% sand, fine to medium; black brown, timber, possibly from piling.
-25									
	40	S-10	24/12	15-8-14-16	PID= 707 ppm			TLO	S-10 (39'- 41') SILTY SAND (SM); 49% sand, fine, 41% fines, low plasticity, 10% gravel, fine, moderate tar-like odor, wet, gray brown, interbedded, timber. Layers of tar coating.
-30									
	45	S-11	24/8	8-6-8-7	PID= 499 ppm			NLO	S-11 (44'- 46') SANDY SILT (ML); ~70% fines, non plastic, rapid dilatancy, ~30% sand, fine to medium; strong naphthalene-like odor, wet, gray brown, timber. Interbedded tar stained fine sand lenses.
-35									
	50	S-12	24/18	2-4-6-12	PID= 588 ppm			TLO	S-12 (49'- 51') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; slight tar-like odor, wet, brown, tar staining, sheen.
-40									

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL
REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING (JAR HEADSPACE)

NA = NOT APPLICABLE
NM = NOT MEASURED
Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK

ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET

NLO = NAPHTHALENE LIKE ODOR
PLO = PETROLEUM LIKE ODOR
TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR

CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
MLO = MUSTY LIKE ODOR

GEI Consultants

GEI Consultants, Inc.
455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Citizens Gas Works
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093250

BORING LOG

PAGE 4 of 6

CGSB-126

ELEV. FT.	DEPTH FT.	SAMPLE INFORMATION: TYPE and NO.	PEN/REC IN./IN.	BLOWS (/6 in.)	FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION
	55	S-13	24/24	5-8-5-7	PID= 233 ppm				S-13 (54'- 56') SILTY SAND (SM); ~60% sand, fine, ~40% fines; trace wood, wet, brown, low cohesion.
-45									
	60	S-14	24/24	4-5-8-9	PID= 195 ppm				S-14A (59'- 59.5') SILTY SAND (SM); ~65% sand, fine to medium, ~35% fines; wet, dark brown, sheen. S-14B (59.5'- 60.5') SANDY SILT (ML); ~60% fines, non plastic, rapid dilatancy, ~40% sand, fine to medium; wet, brown.
								TLO	S-14C (60.5'- 61') SILTY SAND (SM); ~80% sand, fine to medium, ~20% fines; slight tar-like odor, wet, brown.
-50									
	65	S-15	24/15	3-5-7-16	PID= 1104 ppm			TLO	S-15 (64'- 66') SILTY SAND (SM); ~85% sand, fine, ~15% fines, non plastic, rapid dilatancy; moderate tar-like odor, wet, brown.
-55									
	70	S-16	24/NM	3-3-8-11	PID= 402 ppm PID= 98.9 ppm			NLO NLO	S-16A (69'- 70') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; moderate naphthalene-like odor, wet, dark brown, sheen.

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL
REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING (JAR HEADSPACE)

NA = NOT APPLICABLE
NM = NOT MEASURED
Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK

ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET

NLO = NAPHTHALENE LIKE ODOR
PLO = PETROLEUM LIKE ODOR
TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR

CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
MLO = MUSTY LIKE ODOR

CITIZENS 2010_ENV/GEO LOG W/SMWC ALL CITIZENS BORINGS.GPJ NG GINT DATA TEMPLATE.GDT 5/24/11

GEI Consultants

GEI Consultants, Inc.
455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Citizens Gas Works
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093250

BORING LOG

CGSB-126

ELEV. FT.	DEPTH FT.	SAMPLE INFORMATION: TYPE and NO.	PEN/REC IN./IN.	BLOWS (/6 in.)	FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION
								NLO	S-16B (70'- 71') SILTY SAND (SM); ~55% sand, fine to medium, ~35% fines, ~10% gravel, fine to coarse, subangular; max. size 2", slight naphthalene-like odor, wet, brown.
-60									
	75	S-17	24/9	8-15-12-11	PID= 784 ppm			NLO	S-17 (74'- 76') SILTY SAND WITH GRAVEL (SM); ~50% sand, fine, ~35% fines, non plastic, ~15% gravel, fine to coarse; max. size 1.5", slight naphthalene-like odor, wet, brown, cohesive.
-65									
	80	S-18	24/24	8-6-9-10	PID= 9999 ppm			NLO	S-18 (79'- 81') SILTY SAND WITH GRAVEL (SM); ~45% sand, fine to medium, ~30% fines, ~25% gravel, fine to coarse; max. size 2", moderate naphthalene-like odor, wet, brown, cohesive. Tar blebs and globs, tar coated lenses.
-70									
	85	S-19	24/8	5-8-11-11	PID= 400 ppm				S-19 (84'- 86') SILTY SAND WITH GRAVEL (SM); ~50% sand, fine, ~35% fines, non plastic, rapid dilatancy, ~15% gravel, fine; max. size 2", wet, brown, slight sheen.
-75									

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL
REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING (JAR HEADSPACE)

NA = NOT APPLICABLE
NM = NOT MEASURED
Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK

ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET

NLO = NAPHTHALENE LIKE ODOR
PLO = PETROLEUM LIKE ODOR
TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR
CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
MLO = MUSTY LIKE ODOR

GEI Consultants, Inc.
455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Citizens Gas Works
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093250

BORING LOG

CGSB-126

ELEV. FT.	DEPTH FT.	SAMPLE INFORMATION: TYPE and NO.	PEN/REC IN./IN.	BLOWS (/6 in.)	FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION
	90	S-20	24/24	21-21-21-15	PID= 783 ppm			NLO	S-20 (89'- 91') SILTY SAND WITH GRAVEL (SM); ~60% sand, fine to coarse, ~20% gravel, fine to coarse, ~20% fines; max. size 1", moderate naphthalene-like odor, wet, brown.

End of Boring at 91 feet.
Fill with grout.

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL
REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING (JAR HEADSPACE)

NA = NOT APPLICABLE
NM = NOT MEASURED
Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK

ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET

NLO = NAPHTHALENE LIKE ODOR
PLO = PETROLEUM LIKE ODOR
TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR

CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
MLO = MUSTY LIKE ODOR

GEI Consultants, Inc. 455 Winding Brook Road Glastonbury, CT 06033 (860) 368-5300	CLIENT: National Grid PROJECT: Citizens Gas Works CITY/STATE: Brooklyn, New York GEI PROJECT NUMBER: 093250	BORING LOG PAGE 1 of 1	CGSB-141

GROUND SURFACE ELEVATION (FT): 13.50 LOCATION: Parcel III - I14
NORTHING (FT): 671576 EASTING (FT): 632204 TOTAL DEPTH (FT): 13.5
DRILLED BY: Summit Drilling / Jeremy Logel DATUM VERT. / HORZ.: NAVD 1988 / NAD83 NY East Zone
LOGGED BY: Matt Sweet DATE START / END: 12/18/2008 - 12/18/2008
DRILLING DETAILS: Hollow Stem Auger/Mud Rotary / Truck Mounted Mobile 61 / Hammer: 140 lbs / Drop: 30 in.
WATER LEVEL ELEVATIONS (FT): ▽ 0.50 12/18/2008 2:12 pm
GENERAL NOTE:
GENERAL NOTE:

ELEV. FT.	DEPTH FT.	SAMPLE INFORMATION: TYPE and NO.	PEN/REC IN./IN.	BLOWS (/6 in.)	FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION
	0	G-1	60/60	NA	PID= NA ppm				G-1A (0'- 4') Reinforced concrete. HAND CLEARED. FILL. G-1B (1'- 4') Concrete. HAND CLEARED. FILL.
10									
	5	S-1	24/10	2-3-8-10	PID= 0.4 ppm			PLO	G-1C (4'- 5') WIDELY GRADED SAND WITH GRAVEL (SW); ~75% sand, fine to coarse, ~25% gravel, fine to coarse; brown red, HAND CLEARED. FILL. S-1 (5'- 7') WIDELY GRADED SAND WITH GRAVEL (SW); ~80% sand, fine to coarse, ~15% gravel, fine to coarse, angular, ~5% fines; max. size 1.5", slight petroleum-like odor, dry, red brown, brick and concrete fragments. FILL.
		S-2	24/8	17-16-14-7	PID= 1.3 ppm			PLO	S-2 (7'- 9') WIDELY GRADED SAND WITH GRAVEL (SW); ~80% sand, fine to coarse, ~15% gravel, fine to coarse, angular, ~5% fines; max. size 1.5", slight petroleum-like odor, dry, red brown, brick and concrete fragments. FILL.
5		S-3	24/7	4-11-5-13	PID= 1.7 ppm				S-3 (9'- 11') SILTY SAND WITH GRAVEL (SM); ~65% sand, fine to coarse, ~20% gravel, fine, subrounded, ~15% fines; max. size 0.5", dry, brown, FILL.
	10	S-4	24/0	11-8-8-11	PID= NA ppm				S-4 (11'- 13') NO RECOVERY.
▽		S-5	4/1	50/4"	PID= 0.4 ppm				S-5 (13'- 13.3') SILTY SAND WITH GRAVEL (SM); ~45% sand, medium to coarse, ~30% gravel, fine to coarse, ~25% fines; wet, black, brick fragments, metal fragments in tip. Stained. FILL.
0									End of Boring at 13.5 feet. Refusal at 13.5 feet. Boring installed in proposed location. Boring elevation estimated from adjacent spot elevations. *PID readings represent ambient VOC concentrations adjacent to soil sample, not jar headspace concentrations.

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL
REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING (JAR HEADSPACE)

NA = NOT APPLICABLE
NM = NOT MEASURED
Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK

ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET

NLO = NAPHTHALENE LIKE ODOR
PLO = PETROLEUM LIKE ODOR
TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR
CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
MLO = MUSTY LIKE ODOR

Date Start/Finish: 8/27/2015 - 8/31/2015
Drilling Company: Aquifer Drilling and Testing, Inc.
Driller's Name: Dave Moon
Drilling Method: Sonic
Rig Type: HXX Prodigy/Fraste XL-MAX
Sampling Method: 2-inch x 2-foot Split Spoon

Northing: 671571.71
Easting: 632213.86

Borehole Depth: 62 feet bgs
Surface Elevation: 13.4 feet

Descriptions By: Matthew Bell

Well/Boring ID: **CGSBA-305**

Client: National Grid

Location: Former Citizens Gas Works MGP Site
Parcel II (Block 471, Lot 100)
Brooklyn, New York

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blow Counts	N - Value	PID Headspace (ppm)	PP (tsf)	Geologic Column	Stratigraphic Description	Well/Boring Construction
	15										
0										CONCRETE.	
										Bluestone GRAVEL and Silty Sand.	
										Medium Sand, Debris (Brick, Concrete), fragmented Rock, Pebbles. [FILL]	
		NA	NA	NA	NA	NA	NA	NA		Concrete layer at 2.4 feet bgs.	
	10									Concrete layer at 3 feet bgs. Ceramic material, Rubber, Debris (red Brick, Concrete), trace Metal fragments (nails) starting under concrete layer.	
										Hand-cleared to refusal at 4.4 feet bgs.	
5										Drilled without sampling through possible CONCRETE to 20 feet bgs using 5-inch sonic casing.	
	5										Borehole backfilled to existing grade with cement-bentonite grout.
10											
	0										
15											

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface; DNAPL = dense non-aqueous phase liquid; MGP = manufactured gas plant; NA = not applicable/available; NR = no recovery; PP = pocket penetrometer; tsf = tons per square foot; WOH = weight of hammer.

Horizontal reference datum is the North American Datum of 1983 (NAD83), New York State Plane East Zone (FIPS 3101). Vertical reference datum is the North American Vertical Datum of 1988 (NAVD88).

Boring hand-cleared on 8/27/2015 and drilled on 8/31/2015.

Client: National Grid

Well/Boring ID: **CGSBA-305**

Borehole Depth: 62 feet bgs

Site Location:
Former Citizens Gas Works MGP Site
Parcel II (Block 471, Lot 100)
Brooklyn, New York

DEPTH / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blow Counts	N - Value	PID Headspace (ppm)	PP (tsf)	Geologic Column	Stratigraphic Description	Well/Boring Construction
									Drilled without sampling through possible CONCRETE to 20 feet bgs using 5-inch sonic casing.	
20 / -5	1	20-22	0.4	10 11 5 5	16	13.6	NA		Gray fine to coarse subangular GRAVEL, little Sand, trace Silt, medium dense, wet.	
-10										
25	2	25-27	1.7	1 1 1 1	2	2.9 2.5	0.5 0.5		Gray SILTY CLAY, few fine Sand, trace Organics (shells, fibers), high plasticity, no dilatancy, soft, wet. 1-inch layer of Gravel at 25 feet bgs.	Borehole backfilled to existing grade with cement-bentonite grout.
-15	3	27-29	2.0	NA	NA	NA	NA		Shelby tube sample collected. Gray CLAY, some Silt, high plasticity, moist.	
30	4	30-32	1.6	2 2 2 6	4	7.8 172.9	0.5 0.75		Gray CLAY, little fine Sand, trace Organics (shells, fibers), high plasticity, no dilatancy, soft, moist. 1.5-inch layer of gray fine Sand, trace sheen, naphthalene-like odor at 31.4 feet bgs.	
-20										
35	5	35-37	1.0	18 11	21	341.5	NA		Gray to reddish brown SILTY SAND, few Gravel, naphthalene-like odor, trace DNAPL, medium dense, wet.	

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface; DNAPL = dense non-aqueous phase liquid; MGP = manufactured gas plant; NA = not applicable/available; NR = no recovery; PP = pocket penetrometer; tsf = tons per square foot; WOH = weight of hammer.

Horizontal reference datum is the North American Datum of 1983 (NAD83), New York State Plane East Zone (FIPS 3101). Vertical reference datum is the North American Vertical Datum of 1988 (NAVD88).

Boring hand-cleared on 8/27/2015 and drilled on 8/31/2015.

Client: National Grid

Well/Boring ID: **CGSBA-305**

Borehole Depth: 62 feet bgs

Site Location:
Former Citizens Gas Works MGP Site
Parcel II (Block 471, Lot 100)
Brooklyn, New York

DEPTH / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blow Counts	N - Value	PID Headspace (ppm)	PP (tsf)	Geologic Column	Stratigraphic Description	Well/Boring Construction
	5	35-37	1.0	10 7	21		NA		Gray to reddish brown SILTY SAND, few Gravel, naphthalene-like odor, trace DNAPL, medium dense, wet.	
-25										
40	6	40-42	2.0	4 4 7 12	11	544.5 438.9	NA		Brown fine SAND and SILT, trace Clay, naphthalene-like odor, sheen, saturated with DNAPL from 40.3 to 41.9 feet bgs, medium dense, wet.	
-30										
45	7	45-47	1.4	2 4 5 7	9	196.1 265.3	NA		Bright brown SANDY SILT, naphthalene-like odor, some sheen, some DNAPL, non-plastic, stiff, wet. Brown fine to medium SAND, little Silt, naphthalene-like odor, saturated with DNAPL, loose, wet.	Borehole backfilled to existing grade with cement-bentonite grout.
-35										
50	8	50-52	1.0	3 4 6 6	10	34.2	NA		Brown fine to medium SAND, little Silt, naphthalene-like odor, little sheen, loose, wet.	
-40										
55	9	55-57	1.9	4 6	17	62.6	NA		Brown SILTY SAND, naphthalene-like odor, some sheen, medium dense, wet.	

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface; DNAPL = dense non-aqueous phase liquid; MGP = manufactured gas plant; NA = not applicable/available; NR = no recovery; PP = pocket penetrometer; tsf = tons per square foot; WOH = weight of hammer.

Horizontal reference datum is the North American Datum of 1983 (NAD83), New York State Plane East Zone (FIPS 3101). Vertical reference datum is the North American Vertical Datum of 1988 (NAVD88).

Boring hand-cleared on 8/27/2015 and drilled on 8/31/2015.

Client: National Grid

Well/Boring ID: **CGSBA-305**

Borehole Depth: 62 feet bgs

Site Location:
Former Citizens Gas Works MGP Site
Parcel II (Block 471, Lot 100)
Brooklyn, New York

DEPTH / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blow Counts	N - Value	PID Headspace (ppm)	PP (tsf)	Geologic Column	Stratigraphic Description	Well/Boring Construction
	9	55-57	1.9	11 12	17	20.8	NA		Brown SILTY SAND, medium dense, wet.	
-45										Borehole backfilled to existing grade with cement-bentonite grout.
60	10	60-62	2.0	5 5 11 17	16	12.4 6.7	NA		Brown SILT, some fine Sand, trace Clay, trace sheen, very stiff, wet.	
									End of boring at 62 feet bgs.	
-50										
65										
-55										
70										
-60										
75										

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface; DNAPL = dense non-aqueous phase liquid; MGP = manufactured gas plant; NA = not applicable/available; NR = no recovery; PP = pocket penetrometer; tsf = tons per square foot; WOH = weight of hammer.

Horizontal reference datum is the North American Datum of 1983 (NAD83), New York State Plane East Zone (FIPS 3101). Vertical reference datum is the North American Vertical Datum of 1988 (NAVD88).

Boring hand-cleared on 8/27/2015 and drilled on 8/31/2015.

CONSULTING GROUND WATER GEOLOGISTS

ROUX ASSOCIATES INC

GEOLOGIC LOG

Study No. 07703 Date 7/19/89
Project Carroll Gardens
Client Gibbs & Hill
Page 1 of 1
Logged By John C. Sheehan
Well No. GW - 3
Loc.
M.P. Elevation
Drilling Started 2/3/89 Ended 2/3/89
Driller Water Resources, Inc.
Type Of Rig Auger rig

WELL DATA

Hole Diam. (in.) 6.25
Final Depth (ft.) 17.70
Casing Diam. (in.) 2
Casing Length (ft.) 7.69
Screen Setting (ft.) 7.69-17.69
Screen Slot & Type 020 PVC
Well Status

G W READING

Date	DTW MP(2)	Elev. W.T.

SAMPLER

Type split spoon
Hammer 140 lb.
Fall 30 in.

DEVELOPMENT

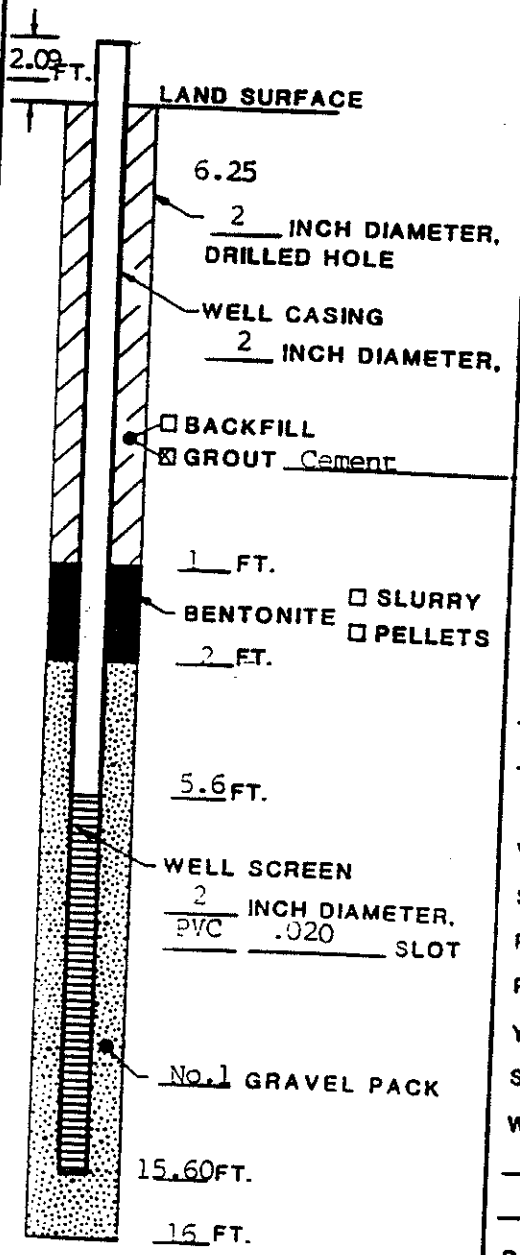
OVM	SAMPLE No.	SAMPLE Rec.	SAMPLE Depth (ft.)	SAMPLE Blows/6"	Strata Change & Gen. Desc.	Depth (ft.)	SAMPLE DESCRIPTION
0.0ppm			0-2'			0	Concrete and pavement.
0.0ppm			5-7'	weight of hammer		5	No recovery.
0.0ppm			10-12'	weight of hammer		10	No recovery.
							B.O.B. = 16'

REMARKS: (1) in feet relative to a common datum
(2) from top of PVC casing

ROUX

Consulting Ground-Water Geologists
ROUX ASSOCIATES INC

MONITORING WELL CONSTRUCTION LOG



NOTE:
ALL DEPTHS IN FEET
BELOW LAND SURFACE

PROJECT NAME Carroll Gardens NUMBER 07703
WELL NO. GW - 3 PERMIT NO.
TOWN/CITY Borough of Brooklyn
COUNTY Kings STATE NY
LAND-SURFACE ELEVATION
AND DATUM ____ FEET ☐ SURVEYED
☐ ESTIMATED
INSTALLATION DATE(S) 2/3/89
DRILLING METHOD Hollow Stem Auger
DRILLING CONTRACTOR Water Resources, Inc.
DRILLING FLUID None
DEVELOPMENT TECHNIQUE(S) AND DATE(S)
pulse pump - 2/8/89
FLUID LOSS DURING DRILLING ____ GALLONS
WATER REMOVED DURING DEVELOPMENT 80 GALLONS
STATIC DEPTH TO WATER 11.53 FEET BELOW M.P.
PUMPING DEPTH TO WATER ____ FEET BELOW M.P.
PUMPING DURATION 1.80 HOURS
YIELD ____ GPM .78 DATE 2/8/89
SPECIFIC CAPACITY ____ GPM/FT.
WELL PURPOSE Monitoring
REMARKS

HYDROGEOLOGIST John C. Sheehan